American Machinist

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What are the reasons for replacing obsolete equipment?
How soon should new equipment pay for itself?
What are the steps taken in buying equipment?
Is group or individual motor drive preferable?
Is a repair cost record worth while?
How are obsolete machines disposed of?
What are the faults of machine tools?
How keep informed of developments in equipment?

Conclusive answers to these questions are of extreme importance to the user of shop equipment. The answers have been given in the *American Machinist* in its series of articles, "Getting the Most Out of Your Machine Tool Dollar." But not all of the leaders of the machinery industries think alike on such subjects and the problems are likely to require different answers in different plants. Therefore cross-sections are presented here of the articles as a whole, the statements of company policies being quoted or abstracted, as they apply to the several questions.

In this article, the FIRST *of a series of eight, answers are given to the question*

What Are the Reasons for Replacing Obsolete Equipment?

The Illinois Central Railroad puts new equipment into its repair shops because the old is worn out; to get lower machining costs by the use of improved machines; and because of requirements for increased output. Among the reasons given in its lists of recommendations for new equipment are these: Machine too light for heavy duty; want to change from former methods to grinding, to reduce time; badly worn and dangerous to operate; old machine of light design and expensive to operate; will not produce good work; under capacity; bad condition and will not pay to rebuild; bad fire hazard; to replace hand labor; motor drive required.

International Harvester—Reduction of shop costs is the prime influence back of replacements made by the International Harvester Co. In replacing serviceable machines by machines of later design and greater productivity, there are considered the costs of tearing out, installation, additional power consumption, delay to production. Disposition of the old machine must be decided: whether it is to be moved to another location in the plant, to another plant, sold, or scrapped. Machines comparatively new will be disposed of if machines of better design and greater productivity can be secured. The tendency of this company is to favor the policy of crowding its machines to a reasonable maximum capacity, to get the most production from them, because of the rapidity with which machinery becomes obsolete.

SKF Industries—"A machine in the plant of the SKF Industries is obsolete when it will no longer pay the dividends obtainable from some other machine. . . . A lack of business sense would be shown by adhering to worn-out or low-production machinery. It is self-evident that worn-out machines cannot be used on precision work. Low-production machines can, but if they are, a price is paid by the user, and that price is either lower profits or higher selling prices." From this quotation it is seen that lower cost of production, by savings in direct labor, is the prime influence toward replacement. Other reasons are the elimination of re-operation work, reduction of re-operation inspection, dis-assembly work, reassembly work, and labor turnover, the last-named being influenced by the elimination of dirty and exhausting jobs.

Delco—It is necessary for Delco (the Dayton Engineering Laboratories Co.) to produce automobile electrical units that are constantly changing to keep pace with the improvements in automobile design. The tendency during the past several years has been toward

units of less weight, and less cost, yet with greater efficiency. "Economical production alone makes possible the profitable fulfillment of such requirements and it is largely upon shop equipment that economical production depends."

Obsolete machines are, of course, replaced. The Delco definition of obsolescence indicates that the equipment problem is not being approached in a haphazard fashion: "Obsolescence as applied to productive machine tools is the result of the elimination of uneconomical manufacturing operations." In enlarging upon the definition Delco's Factory Manager says: "An operation may be done away with entirely, it may be transferred to a machine of greater production, better cutters may be used, or more suitable fixtures may be applied; whatever the step taken, the object is to get away from the wasteful in manufacture. Not every step toward economy in production means the obsolescence of machine tools, but each step tends in that direction and many bring that result directly. When a machine is superseded by one capable of greater output, it has been started on the path of obsolescence. When better cutters or fixtures are applied, it is quite likely to be found that the machine is not capable of the added productivity that is certain to be demanded."

Westinghouse—That the Westinghouse Electric and Manufacturing Co. realizes the close attention that must be given to the purchase, use and disposition of equipment is evident from the fact that it maintains a group of machine tool supervisors who review the equipment every three months, to determine the necessity for additional and replacement equipment. The company's reasons for buying machines are given on its form, "Request for Equipment": Increased production, saving in cost of manufacture; replacement; change in design; new line of apparatus. According to the Director of Works Equipment, "It is evident that the most suitable tools for service intended must be installed and maintained to insure economical manufacturing costs."

Spicer—Constant pressure from the customer for lower prices on the product keeps the Spicer Manufacturing Corporation always seeking cost-saving equipment. As the pressure applied to the sales department makes itself felt by the manufacturing department, the operation sheets are gone over, operation by operation, and the most likely opportunities for savings are selected. Search is then begun for the machines to fill the bill, and is continued until they are found. As a result of this method, comparatively new machines may be discarded.

The Hoover Co., due to its policy of sticking to the standard machine, experiences little difficulty from obsolescence brought about by change in design of machine tools. Change of methods of manufacture and changes in the design of product, cause obsolescence. In selecting a machine, the company considers whether or not the proposed machine is easily convertible to do other operations; to what extent the proposed machine will affect the "in process"; the effect upon floor space; and the effect upon power consumption.

Timken—According to the Timken Roller Bearing Co., "Changes in the design of our product, or in our methods of manufacture, and changes in the design of machine tools, or the introduction of machines of new design, cause practically all of the obsolescence of machine tools." Practically every instance of obsolescence is attributed to a combination of change in method and change in machine design. The small operation, as well as the large, is followed continually, from the equipment angle, because it is realized "that many savings of the small variety mount into a considerable sum when taken as a whole." It is a part of the policy of the company to work its machines to the limit of their capacity because of the rapidity of development in design. Automatic machines, as rapidly as they are developed by the builders, are acquired to replace hand-operated machines.

Corona—The why of replacements made by the Corona Typewriter Co., Inc., is told in the quotation following: "The works manager requires, however, that all requisitions shall be supported by a complete report from the methods division or from the production-equipment engineering department as to the need for the purchase, the cost, savings to result from its use, and all other information bearing on the purchase. . . . Owing to the very fact that so much emphasis is laid upon methods, and because we do endeavor to advance with all advances in production technique, the problem of machine and tool obsolescence is quite important. We have no hesitancy in scrapping a machine or tool, providing it can be shown that such scrapping is beneficial." Due to the obsolescence factor, resulting from changes in methods, changes in design, or replacement by better adapted machinery, the Corona company many times removes from the production departments and offers for sale, machines that are in practically perfect operating condition.

Grand Trunk—With the Grand Trunk Railway System there are two primary reasons for buying machine equipment. One is for replacement of the old machine that breaks or becomes undependable. The second is saving of cost in making repairs, not necessarily because of reduced direct labor, but to prevent idleness of locomotives. "The earnings of a locomotive in service are great enough to make it profitable to expedite repairs, even though the actual saving in labor may not seem to warrant the investment in a new machine tool."

General Electric—From the point of view of the General Electric Co. a machine tool is made obsolete by the development of the art through which the modern tool produces more than the one it supplants, and the nature of the tool and the way it has been treated. Machines are discarded because repairs are too frequent, too costly, and result in repeated non-productive idleness; or because it can be shown that the purchase of another machine of either the same or a totally different type, is a good investment.

Morgan—The Vice-President of the Morgan Construction Co. feels that in his plant, building rolling mills and wire-drawing machinery, the equipment problem is complicated when compared to the same problem in a production shop. Yet he knows that he shares in the necessity common to all shops, to buy the equipment that will return the greatest profit. The general policy adopted, therefore, is "to spare neither time nor expense in purchasing such equipment as will enable us to secure the best investment, as nearly as it can be determined." Among the specific reasons for replacement are old age, quite likely to be indicative that the machine is a back

number; lack of sturdiness; inaccuracy; and difficulty in securing the greatest interest of the operator in his work when he is handling a machine that is out of date.

Gleason—Certain jobs, on which set-up and idle time predominates, are performed on old machines at the Gleason Works. In spite of that fact the average age of the equipment is seven years, a conclusive indication of the company's belief in modern equipment. The company maintains its cost records on a machine-tool hour basis, and first consideration, therefore, is given to the *speed of production* in determining whether or not to replace a machine. The second consideration is the constant demand for *better quality*. Third consideration is given to the *items of expense* that make up the cost per hour. *Idle time* is considered, the idle time due to inability to keep the new machine supplied with work on account of its great productiveness being against replacement, and idle time due to break-down of the old machine being in favor of replacement.

The National Cash Register Co. makes its replacements upon the basis of finding more efficient methods and equipment; of finding the method of production to secure the maximum output with the greatest possible protection of the employee's health and life.

Western Electric—What is back of replacement at the Hawthorne Works of the Western Electric Co. is shown in this quotation: "No manufacturer today would think of operating a plant that was not equipped for the greatest possible production. Nor would he, if he realized to the slightest degree the value of maintaining perfect morale and efficiency among his workers, consider for a moment the presence of equipment that did not assure as safe conditions for the operator as it is humanly possible to attain. . . . Efficient and safe production on such a basis hinges entirely upon the proper use of plant equipment. Essentially, it is a question of the most economical utilization of existing facilities and the purchase of new equipment to the best possible advantage."

The Chrysler Corporation in deciding whether or not to purchase new production equipment, is governed primarily by the possible reduction in direct labor. Machines are replaced when in need of repairs in excess of what is justified by their past performance; when the quality of the product is below the Chrysler standard; and when direct labor can be reduced materially. The type of machine particularly interesting to the Chrysler corporation is the one that, after being loaded by the operator, goes through its functions and stops in the unloading position. By this type of machine highly skilled operators are eliminated.

Hupp—"To get more out of the dollar invested" is the prime reason of the Hupp Motor Car Corporation for replacement. Monthly repair expense reports are largely influential in determining the initiation of requests for replacement equipment.

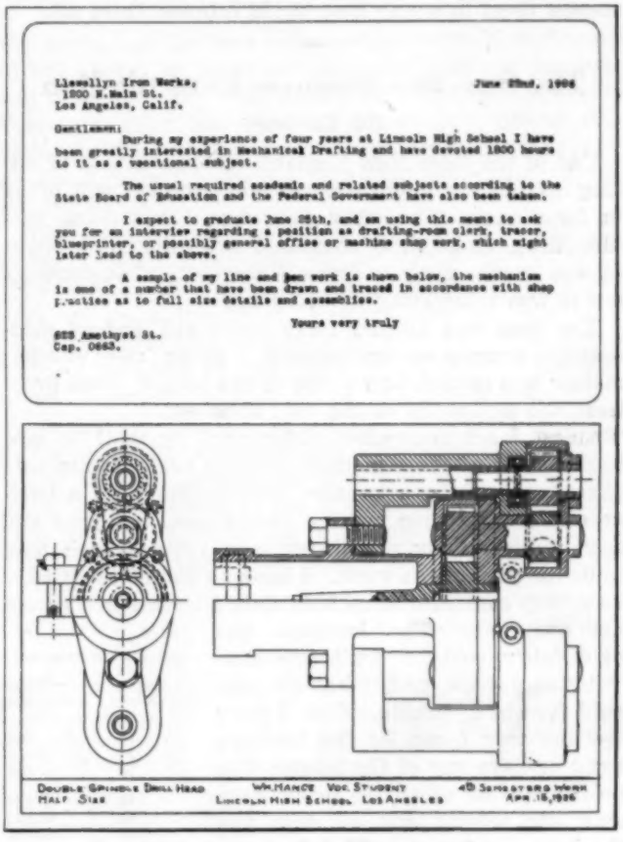
The old saying, "Don't let pleasure interfere with business," is not altogether right. Work and pleasure should harmonize. If you don't get pleasure out of your work the chances are that you will have a hard time seeking it outside of your work.

Placing the Trade School Graduate

By Chester E. Josselyn

Every vocational teacher knows that after helping to develop a marketable product, namely, young men ready to begin working at their trade, it is a joy to use every means possible to assist in putting the product on the market. Having a class of mechanical drafting students graduating in June, the problem of helping them to find positions presented itself, and finally a solution was found which we consider unique, and which resulted in finding positions for the boys with the minimum of waste effort, and without any lost time from school.

Each student selected one of the drawings that he had made during the course, and traced it on a 9x12-in. sheet, leaving room for a letter to be typed at one end.


Llewellyn Iron Works,
1800 N. Main St.
Los Angeles, Calif.

June 25th, 1926

Gentlemen:

During my experience of four years at Lincoln High School I have been greatly interested in Mechanical Drafting and have devoted 1800 hours to it as a vocational subject.

The usual required academic and related subjects according to the State Board of Education and the Federal Government have also been taken.

I expect to graduate June 25th, and am using this means to ask you for an interview regarding a position as drafting-room clerk, tracer, blueprinter, or possibly general office or machine shop work, which might later lead to the above.

A sample of my line and pen work is shown below, the mechanism is one of a number that have been drawn and traced in accordance with shop practice as to full size details and assemblies.

Yours very truly

823 Amethyst St.
Cap. 0863.

Double Grinding Drill Head
Half Size

Wm. Nance Voc. Student
Lincoln High School, Los Angeles

Assembled Work
Apr. 15, 1926

A novel employment application

Fifteen blueprints were made from each tracing, and each boy typed his individual letter of application on the white space blocked out on the print, thus furnishing a sample of his work with the application, as shown in the illustration. The method brought results in all cases.

It is entirely feasible, other conditions being constant, to determine the best form to which cutting tools should be ground. It appears to be a logical conclusion that, with the form determined, it should be reproduced exactly at each grinding. The proper way to secure such a result is to have the tools ground on a machine set according to graduations, and gage them according to the fixed standards, rather than depending on hand grinding and visual inspection.

Answering Shop Questions

BY CHARLES KUGLER

In large plants where I have been employed some time daily is reserved for instructing apprentices in mathematics and drawing, yet no attention at all is given to what I call shop philosophy. This deals with the why of things that occur every day in the shop. I find apprentices asking such questions as: Why is a hand file made tapering and a machine file parallel? Why can high-speed steel be hardened in air or oil, when carbon steels won't harden in air?

The why of these things and many others should be part of the training of the apprentice. Many older mechanics would also be interested in these questions and answers. The apprentices should be encouraged to ask questions concerning the why of things that come up in the shop, and a good teacher can look them up and answer them in a way that would interest them all.

The One Man Business Runs the Man

BY ENTROPY

One of the older New England customs is that of sitting around the kitchen to see what the cat will bring in for dinner. The other day when I was doing just this thing, figuratively speaking, what the cat brought in was hardly likely to bring a modicum of sustenance, but it was interesting nevertheless.

The man was around forty years old, and of moderately prosperous appearance. After the weather matter was settled, and a few of the larger world problems, the real object of the visit came out.

"What I am up against right now," he said, "is how to put some of these modern ideas of organization into effect. I have been twenty years building up a business in a little shop making hand-forged andirons and such, built all my machinery, and trained each man to do his part of the work. I have no patents, so I have been very careful that no man should know much except his own job. The business has paid fairly well. I don't owe anything to anyone, and it has all been paid for out of profits. Now, I don't see any way I can let the business grow or have any of the leisure that belongs to me except to teach some man my secrets and let him run the business for me. That is something that I don't want to do. It has cost me a lot of money to develop my ideas, and I don't know anyone who is willing to pay for it. Everyone wants to draw a good salary from the start, learn my secrets, and then there is no way to prevent him from quitting and going to some competitor, or competing with me on his own account."

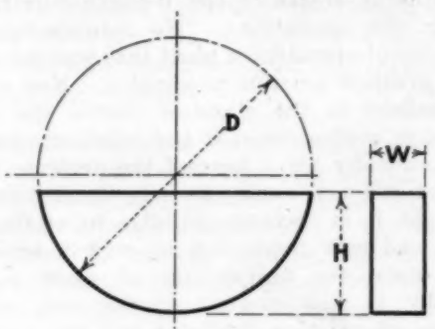
This man's attitude is not an uncommon one. Before anyone could advise him as to the value of his secrets he would have to tell what the secrets were, and then they would no longer be secrets. I suspect that if he got out and looked around a bit he would find that his competitors had better methods, practiced openly. It is seldom that a man working alone ever evolves as good a way of doing a job as comes from the natural evolution in a shop where everyone is interested.

Of course I told him that the thing to do was to find some man with money to put some into the business in the hope that the secrets were not overvalued, but he fears that any such man will not have brains enough to carry on his shop and be of any real help. The natural outcome of which is that he will go back home and run his shop for the rest of his life on a small scale, and be tied down so that he won't dare to step out of town a single working day as long as he lives.

Proposed Tentative American Standards for Woodruff Keys

Sub-committee No. 5 of the Sectional Committee on the Standardization of Shafting offers for consideration the following dimensions as "Proposed Tentative American Standards for Woodruff keys." It is the plan of the committee to work on the standardization of tolerances for keyslots and keyways for Woodruff keys after standards for the keys have been adopted.

The earnest consideration of everyone interested in Woodruff keys is desired. Comments should be sent to the secretary of the sub-committee, L. C. Morrow, Managing Editor of *American Machinist*.



Key Number		Diameter of Key[2] (D) Maximum[1]	Diameter of Key[2] (D) Minimum	Height of Key[2] (H) Maximum[1]	Height of Key[2] (H) Minimum	Width of Key[2] (W) Maximum	Width of Key[2] (W) Minimum[1]
(1)	10	0.500	0.490	0.203	0.198	0.0635	0.0625
(2)	20	0.500	0.490	0.203	0.198	0.0948	0.0938
(3)	30	0.500	0.490	0.203	0.198	0.1260	0.1250
	40	0.625	0.615	0.250	0.245	0.0948	0.0938
	50	0.625	0.615	0.250	0.245	0.1260	0.1250
	60	0.625	0.615	0.250	0.245	0.1573	0.1563
	70	0.750	0.740	0.313	0.308	0.1260	0.1250
	80	0.750	0.740	0.313	0.308	0.1573	0.1563
	90	0.750	0.740	0.313	0.308	0.1885	0.1875
	100	0.875	0.865	0.375	0.370	0.1573	0.1563
	110	0.875	0.865	0.375	0.370	0.1885	0.1875
(A)	115	0.875	0.865	0.375	0.370	0.2510	0.2500
	130	1.000	0.990	0.438	0.433	0.1885	0.1875
	150	1.000	0.990	0.438	0.433	0.2510	0.2500
(B)	155	1.000	0.990	0.438	0.433	0.3135	0.3125
	160	1.125	1.115	0.484	0.479	0.1885	0.1875
	180	1.125	1.115	0.484	0.479	0.2510	0.2500
(C)	185	1.125	1.115	0.484	0.479	0.3135	0.3125
	210	1.250	1.240	0.547	0.542	0.2510	0.2500
(D)	215	1.250	1.240	0.547	0.542	0.3135	0.3125
(E)	225	1.250	1.240	0.547	0.542	0.3760	0.3750
	230	1.375	1.365	0.594	0.589	0.3135	0.3125
(F)	235	1.375	1.365	0.594	0.589	0.3760	0.3750
	240	1.500	1.490	0.641	0.636	0.2510	0.2500
	250	1.500	1.490	0.641	0.636	0.3135	0.3125
(G)	255	1.500	1.490	0.641	0.636	0.3760	0.3750

All dimensions given in inches.
[1] Basic dimensions.
[2] Tolerance on Diameter of Key (D) is minus 0.010 inch
Height of Key (H) is minus 0.005 inch
Width of Key (W) is plus 0.001 inch

The Application of Brakes to Industrial Machinery

By F. C. Stanley
Chief Engineer, The Raybestos Co.

Machine tools are usually inadequately provided with brakes—Function of a brake—Types of brake suitable for machinery—Methods of application—Advantages

UNTIL a very recent date designers have apparently failed to recognize the value of an efficient and conveniently located brake for saving time in the operation of a machine tool or an industrial machine. Many machine tools, even to the present day, are unprovided with any direct means of stopping, and are dependent upon pressure from the hand of the operator to bring them to rest quickly.

The necessity for mechanical brakes for the control of machines was probably first recognized in industrial manufacturing machines, especially for machines operated by female employees. The application of the brake to machine tools came when the latter were employed on competitive production work. For a long time safety engineers overlooked the fact that operators of lathes and other machine tools that were being used on production work, and stopped every few minutes, were obliged to place their hands with force on a moving part in order to bring the machine to a stop. A noted example is that of a 30-in. motor-driven lathe that required a period of several minutes to bring it to a stop without pressure from the operator's hand. Statistics from two leading industrial States, where 12,191 machinery accidents were recorded during the year 1923, showed that 50 per cent of the accidents occurred while starting or stopping machines.

The function of a brake is to absorb energy by the creation of a frictional resistance, and thereby reduce the speed or bring the machine to a state of rest. The absorbed energy is equivalent to that of all of the rotating parts, and the final action of the brake is to dispose of this energy by transforming it into heat and dissipating it in the air. The design of a mechanical brake, therefore, must take into consideration a proper material for the heat absorption and dissipation, as well as the application of the frictional resistance to the moving parts.

The common form of block brake, such as the elementary beam brake used on railway cars, which applies metal shoes to the wheels, causes an excessive pressure upon the shaft bearings, and is, therefore, seldom applicable to an industrial machine. This direct braking pressure on the shaft, or spindle, of the machine, is largely eliminated by the use of two brake blocks located opposite each other. This class of brake has been employed successfully for cranes and hoists.

The simplest commercial modification of the double-block brake is found in the external band brake, which finds its most extensive use in automobiles. In the band brake a metal band lined with a friction material encircles the brake wheel or drum, and is so arranged that it may be tightened by the action of a force on a lever. The three elementary types of outside band brakes are shown in Fig. 1, 2 and 3. It will be noted that a band brake should be designed so that the pull will always come upon the anchorage. The simple band brake as illustrated in Fig. 1, therefore, is only suitable where the rotation is in one direction. The application of the band as in Fig. 2 makes it applicable to a shaft rotating in either direction, but the wrapping is merely against

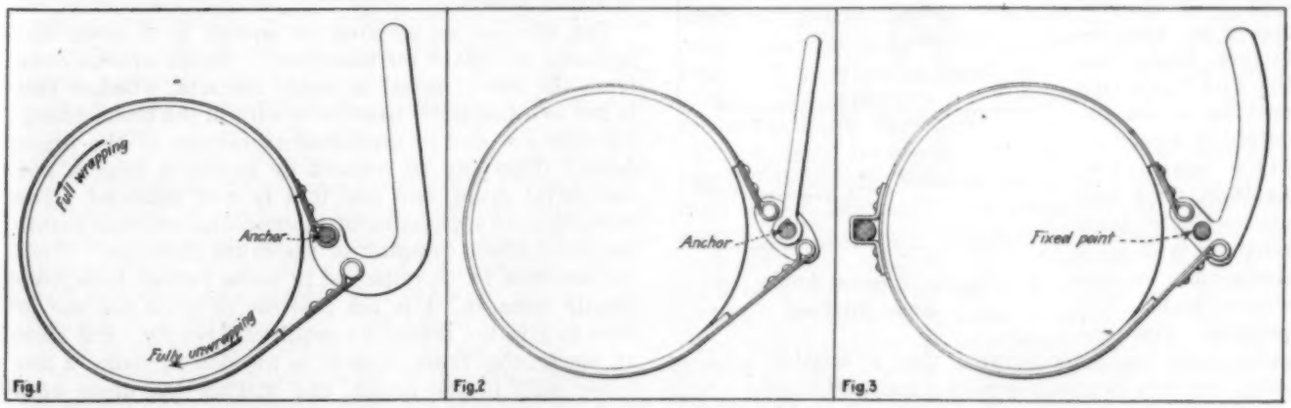


Fig. 1—Band brake for rotation in one direction. Fig. 2—Brake for checking motion in both directions. Fig. 3—An efficient type of brake for machinery

the force with which the brake is applied. The ideal brake for machinery is shown in Fig. 3. The upper half of this brake wraps to check clockwise rotation, and the lower half wraps to check rotation in the opposite direction.

The internally applied brake is similar in principle to the external brake, but the mechanical application of the latter is easier, due to the greater facility with which a wrapping band can be applied externally. Under ordinary circumstances, therefore, the external brake would be the simplest for machine application. In the conical brake, illustrated in Fig. 4, the pressure is applied in a direction parallel to the axis of rotation. The disk brake is a special form of conical brake having the cones opened out into plane disks. When the disk brake contains one or more separate disks of special friction material it is sometimes called a washer brake.

One of the most important factors to be considered in the design of a brake for a machine is the material in the rubbing surfaces. The machine designer usually finds that the material in the brake sleeve, or drum, is limited to steel or cast iron by other design conditions in the machine, and that his variable factors for friction and heat dissipation must be looked for in the brake band. Metal to metal contacts in a machine brake are almost out of the question, because of the excessive squeak for the confined space of a machine shop, and the low efficiency due to accidental lubrication. Designers early turned to wood and leather as lining materials for brake bands, but both of these materials have the disadvantage that part of the heat of braking is used in drying and burning the lining, rendering it unfit for severe service.

The greater the coefficient of friction, the higher must be the dissipating power of the brake to dispose of the heat generated in the shorter space of time. The coefficient of friction of wood rubbing on iron or steel is considerably higher than that for iron on iron, but the wood is subject to easy burning, and makes an unsatisfactory brake for the continuous braking action required in a production machine. Leather, fiber and canvas have been tried out with similar results on this class of brake. Experience with the automobile has demonstrated that a reliable braking effect can only be obtained with a material having a high coefficient of friction and a non-combustible nature. Material of this class is now going into the construction of all automotive brakes.

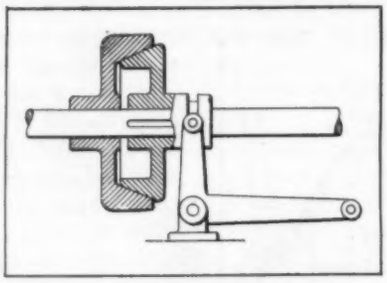


Fig. 4—Conical brake for axial braking

The frictional resistance produced by a brake, when converted into heat by the absorption of the energy of the moving parts of the machine, must be dissipated from the brake by conduction or radiation. In an industrial machine or a machine tool it is desirable that as much as possible of this heat be carried off by the brake band in order to prevent an appreciable rise in temperature of the brake drum, which is usually an integral part of the machine. With wood or leather lining in the brake band it has been found that temperatures exceeding 450 deg. F. will char the lining, but with the improved non-combustible brake lining it is safe to allow the heat to build up at a faster rate through the band itself. For example, an asbestos lining will withstand temperatures above 900 deg. F. The heat generated in this type of brake is thus carried away from the vital parts of the machine. In Fig. 5 is shown an impregnated non-combustible friction lining riveted to a band brake. This class of brake, with modification of lever and anchor design to meet the conditions, is applicable to almost any type of industrial machine. Its light open construction, and clear radiating space, permits an easy radiation of the heat generated. In the design of a band brake all of the factors may be reduced to a force diagram and the calculations made for the width of band and the necessary force to be applied on the brake lever. The pin at the anchorage need only be large enough to resist safely the bending movement and pressures on it. The thickness of the band should be as little as possible in order not to consume any great part of the force applied to the operating lever. A band brake for a machine tool should always be of a type capable of application for rotation in either direction.

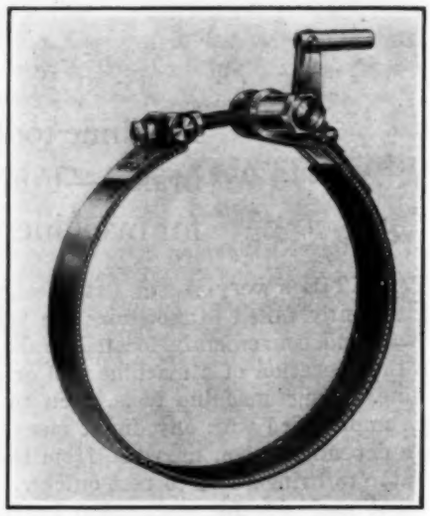


Fig. 5—Band brake with a non-combustible friction lining

The elimination of noise or squeak is of great importance on brakes for machinery. Brake squeals come from the use of metal to metal contacts, whether this is due to a full metal band or to wire in the brake lining. Squeaks are due to unmuffled vibrations of the brake drum. They can be reduced by having a smooth and concentric drum, and one that is well balanced. The simultaneous application of internal and external brakes assures perfect damping of the drum vibration. Since the asbestos yarns employed in brake linings have little tensile strength, it is not possible to avoid the use of wire to give the fabric the required strength. But most of the trouble from squeaks is avoided by using a fine brass wire in the lining, and making the drum of a higher carbon steel, or of gray iron. Lubricants should never be used to prevent squeaks in a brake. The coefficient of friction of the brake lining is reduced by the application of a lubricant, and the efficiency of the brake is reduced. Moreover a lubricated brake will collect dust or abraded material, and disastrous "grabbing" of the brake will occur.

No attempt will be made here to give the mathematical calculations for determination of the dimensions of the brake, as all of the older methods and formulas are directly applicable to the modern brake with impregnated band lining. The coefficient of friction of a good impregnated lining, however, will be approximately 0.45

as compared with 0.30 for wood against cast iron. The points essential to the machine designer are: to call for a material in the brake drum hard enough to prevent scoring; to design his levers to cause the band to wrap around the drum with equalized pressure; to employ a non-combustible lining with only soft wire in the fabric, and to attach it with soft rivets.

The advantages of the application of brakes to industrial machinery cannot be overestimated. Dependance upon the hand of the operator as a brake for a heavy machine is both dangerous and unreliable. At the same time it is unfair to the operator because of the increased liability to personal injury. The application of a brake to almost any machine is a relatively simple matter, and can usually be done without any serious alterations in design.

The Importance of Finish

BY HARRY HOISINGTON

The final appearance, or finish, of any job is more of a factor in the success of the job than one is apt to realize. It is the appearance of a job by which the average citizen judges of the good or indifferent character of the workmanship. Hence, poor finish lowers sale values. The appearance of a machine or tool, also, has a great deal to do with the amount of care that will be taken to keep it in good order.

Many a complaint of inefficiency from farm machinery, for example, would never be received if the machine had more pleasing lines or a more durable coat of paint, simply because the good appearance inspires the owner and operator to regular care, lubrication, and cleaning.

High polish costs money, and a considerable part of a tyro's education may be along the line of how not to do it. But at least the apprentice should be given the reasons for finishing the piece as wanted. It should be explained why some bearings are ground and others finished with a file, why piston rods are draw-filed lengthwise and small file marks left in to draw lubricating fluid through the stuffing box. This sort of a thing may react to the benefit of the shop in other ways. Shops have been known to change their established practices when the management tried to give the apprentices reasons for the methods in use.

The grade of workmanship on a finished surface is usually to be judged by the character of the surface. A few scratches or dents on a polished surface utterly spoil it. Accidental streaks and splotches off color are ruinous in a painting job. Yet intentional and regular striping is often used to enhance the effect.

It does not mean anything to say that a surface must be smooth. In "repousse" ornamental work the hammer marks are neither regular nor of a uniform size, yet a proper decorative finish is obtained. This is because the whole surface is of the same general and uniform character.

It is safe to say that few present-day mechanics have had full instruction on finish. The best workmen in jobbing shops become known for their innumerable tricks of finish. The small detail of rounding a corner or of leaving it sharp may serve to distinguish the thorough mechanic. The presence or absence of scratches in the file work, chatter or feed marks on machined surfaces, or deformation by chuck jaws or clamps, are things by which a workman is judged.

Seen and Heard

BY JOHN R. GODFREY

Salvage and Waste

IT IS rather funny how what passes for the human mind jumps at a semblance of an idea, takes it as gospel truth, and chases it blindly to absurd lengths. Long years ago, in one of the early throes of so-called efficiency, we were told that time was so much more valuable than material that it was a waste of money for a carpenter to pick up the nails he scattered about from time to time.

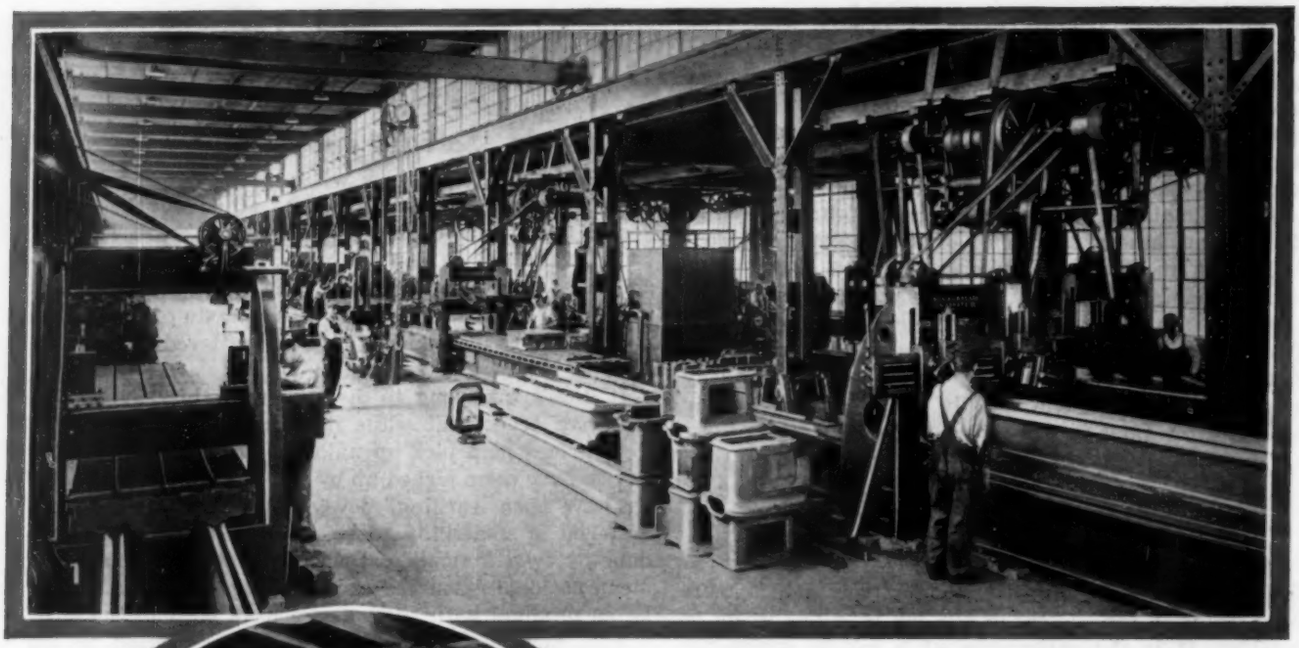
It didn't take long to discover that this saying was only half true; that while it might not pay to have a high priced man pick up nails, it most certainly would pay to have them picked up by a boy at low wages. And we have been learning, slowly but surely, I hope, that material is something to be saved whenever it can be done at even a small margin of profit. For materials mean national resources and we cannot always afford to be as prodigal with them as we have been in the past.

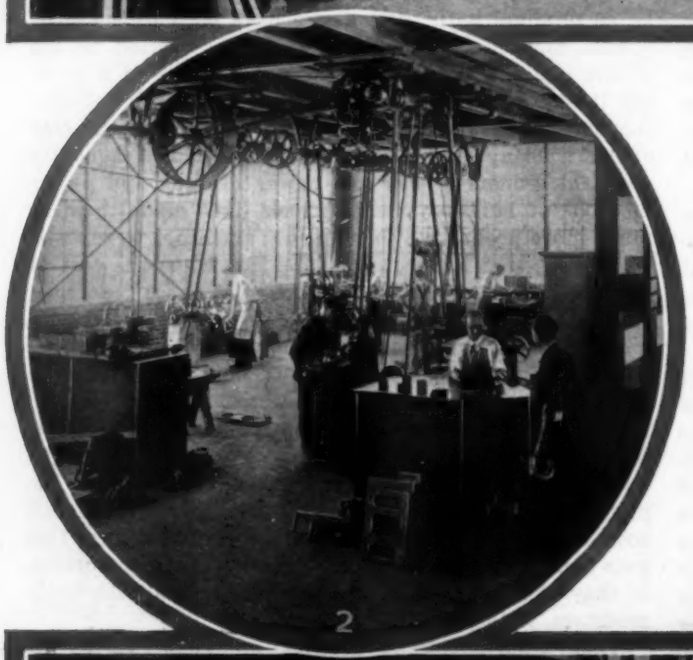
Just how far this salvaging can be carried to the ultimate advantage of all concerned, is more of a problem than may appear at first. If it refers to the rebuilding of old and decrepit machinery that affects the cost of work being done, day after day, it is frequently doubtful economy. For the newer designs and newer methods of building machine tools have made them so much more productive than the old machines were, even when new, that it is often a total loss when the cost of work to be done is considered. In such cases repair, or salvage, should never be attempted if it is possible to get a new and improved machine. The old and out-of-date machine belongs in the cupola, unless it happens to be worth more than junk to some small repair shop.

When it comes to material, however, such as bolts, nuts, bars, etc., or even some types of machinery, the question of salvage is always to be considered. In too many cases, however, the cost of patching up old stuff costs a lot more than the estimates. And that very fact gets a lot of repair shops in bad with their customers, if they charge enough for their work, and with their creditors, if they don't.

Take such innocent articles as globe valves or monkey wrenches, for example. They may be just a little out of gear and it seems a pity to throw them away. But just figure the cost of a man's time to put them in shape, against the cost of new ones and see what happens! A man naturally objects to paying two dollars for repairing a valve he bought for half that when new—and yet it may easily cost two or three dollars to take a valve apart, repair the parts and reassemble it.

Much can be done in many places to prevent waste by careless handling, by mislaying or dropping bolts, nuts, washers and the like. The annual waste of small parts and the damage caused by rust on parts left exposed to the weather, runs up into millions of dollars. The prevention of this waste is one of the duties of every shop manager, so far as lies in his power. Systematic issuance of parts, and care in the handling of them while in process of assembly, will help considerably. But perhaps the greatest assistance may come from instilling in the minds of both managers and workers, a realization that waste is a menace to any nation, and that no nation is rich enough to afford it.





A New Lathe Shop

Boye & Emmes Machine Tool Co., Cincinnati, Ohio

Old shop burned Jan. 27, 1926. Patterns and drawings of new geared head lathe saved. New Austin-type factory, 90x350 ft., completed in July, 1926. Illustrations show construction and light. Special attention paid to floor and foundations. All new machines have individual motor drive. Planers have variable speed countershafts; other machines in convenient groups

Fig. 1—Planers at front end of shop

Fig. 2 — Toolroom — note light and metal furniture

Fig. 3—Lathes at back end of shop

Tools for Making Tools

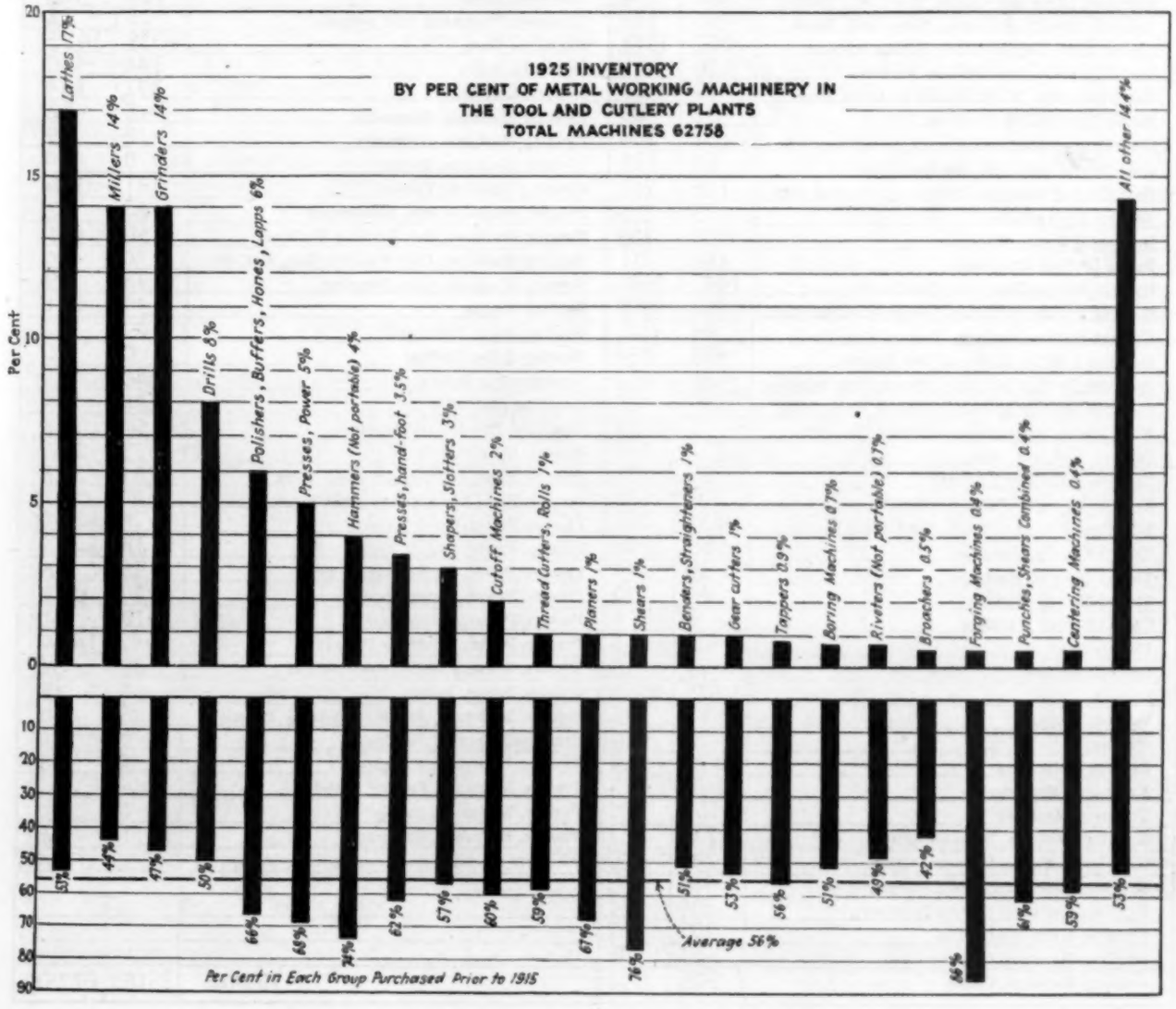
The Numbers, Types and Ages of Metal-Working Equipment in the Tool and Cutlery Plants

EIGHTY-THREE representative plants in the tool and cutlery division of the metal working industries went to considerable effort to answer the questionnaire sent out by the *American Machinist*. These answers with plant data secured from the United States Census Reports provided the basis for the figures here given to cover equipment in the plants engaged in this line of work, and employing 6 or more men. The method of expansion was based on a constant relation between operators and machines in plants with similar products.

The total inventory is given in terms of per cent by groups of given types of machines in the upper half of the chart. The percentage, in each group, of the totals purchased prior to 1915 is shown in the lower half. For example, machines for turning account for 17 per cent of the installed equipment. Of these machines 53 per cent have seen ten years or more of service, which is 3 under the average 56 per cent.

According to the U. S. Census for 1923, on which these figures are based, there is a total of 715 plants in the tool and cutlery division employing an average total of 54,917 men. Of this plant total, 322 plants are in a group which employ not more than 20 men per unit, having a balance of 393 plants of 21 or more workers. The largest single group from the standpoint of workers is that employing between 101 and 250 men. In this group there are 75 units and an average total of 11,454 workers.

The body of the original questionnaire is reproduced on the next page and filled in with the figures in detail.



METAL WORKING EQUIPMENT IN THE TOOL AND CUTLERY PLANTS

Kind of Machine Tool	A Number Built Before 1915	B Total Number in Plants 1925	Kind of Machine Tool	A Number Built Before 1915	B Total Number in Plants 1925
Engine Lathes	2280	4160	Grinding Machines, Floor, No Feed Attachments	1201	2190
Hand Turret Lathes	241	552	Grinding Machines, Bench, No Feed Attachments	221	804
Power Turret Lathes	311	665	Grinding Machines, Disk	202	424
Semi-Automatic Lathes	57	190	Grinding Machines, Belt	620	1265
Hand Screw Machines	411	652	Grinding Machines, Centerless	44	96
Automatic Screw Machines, Single Spindle	594	976	Polishing and Buffing Machines, Wheel	2205	3060
Automatic Screw Machines, Multiple Spindle	291	811	Polishing and Buffing Machines, Belt	152	348
Chucking Lathes	101	190	Polishing and Buffing Machines, Semi-Automatic	108	196
Multiple Spindle Chucking Machines, Rotary Work	0	19	Lapping Machines	70	196
Multiple Spindle Chucking Machines, Rotary Tools	0	0	Honing Machines	19	38
Speed Lathes	494	753	Cutting-Off Machines, Parting Tool Type	6	19
Bench Lathes	433	710	Cutting-Off Machines, Power Hack Saw Type	544	982
Tool Room Lathes	500	1132	Cutting-Off Machines, Rotary Cold Saw Type	215	298
Wheel Lathes	0	0	Cutting-Off Machines, Band Saw Type	108	183
Axle Lathes	0	0	Cutting-Off Machines, Friction or Hot Saw	25	25
Forge Lathes	0	13	Shears, Knife	455	582
Hand Milling Machines	588	862	Shears, Rotary	25	44
Bench Milling Machines	107	139	Shears, Slitting	32	51
Plain (Knee and Column Type) Milling Machines	1112	2235	Nibbling Machines	25	25
Universal (Knee and Column Type) Mill. Mach.	564	1284	Hammers, Steam	336	462
Vertical (Knee and Column Type) Mill. Mach.	405	583	Hammers, Pneumatic (not portable)	25	32
Lincoln Type Manufacturing Milling Machines	1062	1372	Hammers, Drop	1038	1455
Semi-Automatic Type Milling Machines	126	411	Hammers, Helve	348	430
Continuous Mill. Mach. Rotary or Drum Type	19	51	Hammers, Spring	272	354
Planer Type Milling Machines	32	96	Riveting Machines, Pneumatic	13	82
Gear Cutting Machines, Rotary or Milling Type	152	304	Riveting Machines, Hydraulic	19	19
Gear Cutting Machines, Hobbing Type	63	139	Riveting Machines, Steam	0	0
Gear Cutting Machines, Planing or Shaping Type	126	202	Riveting Machines, Power	171	316
Vertical Boring Mills	133	228	Forging Machines, Hot, Bulldozers	63	82
Horizontal Boring Machines	108	209	Forging Machines, Hot, Forging Machines	158	171
Radial Drilling Machines	184	411	Forging Machines, Cold Headers, Bolt, Nut, etc.	0	0
Upright Drilling Machines, One Spindle	1455	2690	Forging Machines, Cold, Swaging	13	19
Upright Drilling Machines, Two or More Spindles	481	1000	Bending Brakes	44	171
Upright Drilling Machines, Two or More Heads	44	215	Bending Rolls, Horizontal	57	63
Sensitive Drilling Machines, One Spindle	468	894	Bending Rolls, Vertical	0	0
Sensitive Drilling Machines, Two or More Spindles	76	152	Straightening Rolls	240	436
Sensitive Drilling Machines, Two or More Heads	19	25	Punching Machines	108	164
Two-, Three- and Four-way Drilling Machines	6	32	Combined Punches and Shears	57	108
Tapping Machines, Single	278	506	Presses, Hand, Arbor	652	1246
Tapping Machines, Multiple	25	38	Presses, Hand, Light Punch Press Work	291	323
Pipe Threading and Cutting Machines	101	158	Presses, Foot, Light Punch Press Work	380	563
Bolt Threading and Cutting Machines	234	323	Presses, Power, Crank Type	874	1228
Thread Chasing Machines	96	202	Presses, Power, Toggle Type	38	57
Thread Hobbing Machines	25	44	Presses, Power, Double-Acting Type	25	38
Thread Milling Machines	44	120	Presses, Power, Dieing Type	177	342
Thread Rolling Machines	6	6	Presses, Power Automatic	19	51
Planers	443	658	Presses, Power, Trimming Presses	1042	1480
Open-side Planer	25	38	Presses, Power, Forcing, Arbor, Wheel	32	96
Shapers	925	1631	Presses, Power, Baling	0	13
Vertical Shapers	63	96	Presses, Hydraulic, Bending, Forming, Drawing	25	70
Slotters	70	114	Presses, Hydraulic, Forging	6	6
Broaching Machines	128	304	Presses, Hydraulic, Flanging	6	13
Keyseating Machines	70	133	Presses, Hydraulic, Forcing, Wheel, etc.	44	44
Centering Machines	152	260	Presses, Hydraulic, Baling	0	0
Grinding Machines, Plain Cylindrical	228	633	Presses, Hydraulic, Extruding	6	6
Grinding Machines, Universal Cylindrical	291	570	All other machines and miscellaneous, please list:	4605	8775
Grinding Machines, Surface, Reciprocating	418	766			
Grinding Machines, Surface Rotating	304	481			
Grinding Machines, Internal	202	507			
Grinding Machines, Cylinder	32	96			
Grinding Machines, Cutter	525	1176	TOTALS	35189	62758

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

Methods used in holding an awkward-shaped piece for various machining operations in the Cleveland plant—Standard machines used

THE differential housing is one of the awkward pieces to hold for machining and the tooling is also something of a problem. For, since it carries the axle driving gears as well as the differential, the housing must be machined accurately in order to secure proper alignment of the drive shaft and the rear axle. This article shows how the work is handled in the shop of the Cleveland Automobile Company.

Boring and threading the driveshaft end is the first operation, as in Fig. 1. The casting is held in a heavy, air-operated chuck, the air valve being conveniently located at *A*. The machine is a Warner & Swasey turret lathe, fitted with heavy boring bars and a collapsing tap for the threading of the end for the adjusting and locking nuts. The boring bar *B* carries three sets of cutters.

The housing flange is drilled on a Natco machine on a combination fixture that also handles the differential carrier, as in Fig. 2. While this view shows two carriers in place, the housings are drilled in the same fixture, using a different grouping of the drill spindles. The fixture makes a station machine for this operation, the two groups of drills completing the operation at each movement of the head.

Locating the housing by dowels in the holes just drilled, the cross holes for the axle bearings are bored in the double-head Munson machine, Fig. 3. The boring bars are guided in heavy bearings close to the work in

The twelfth article. The thirteenth will appear in an early issue.

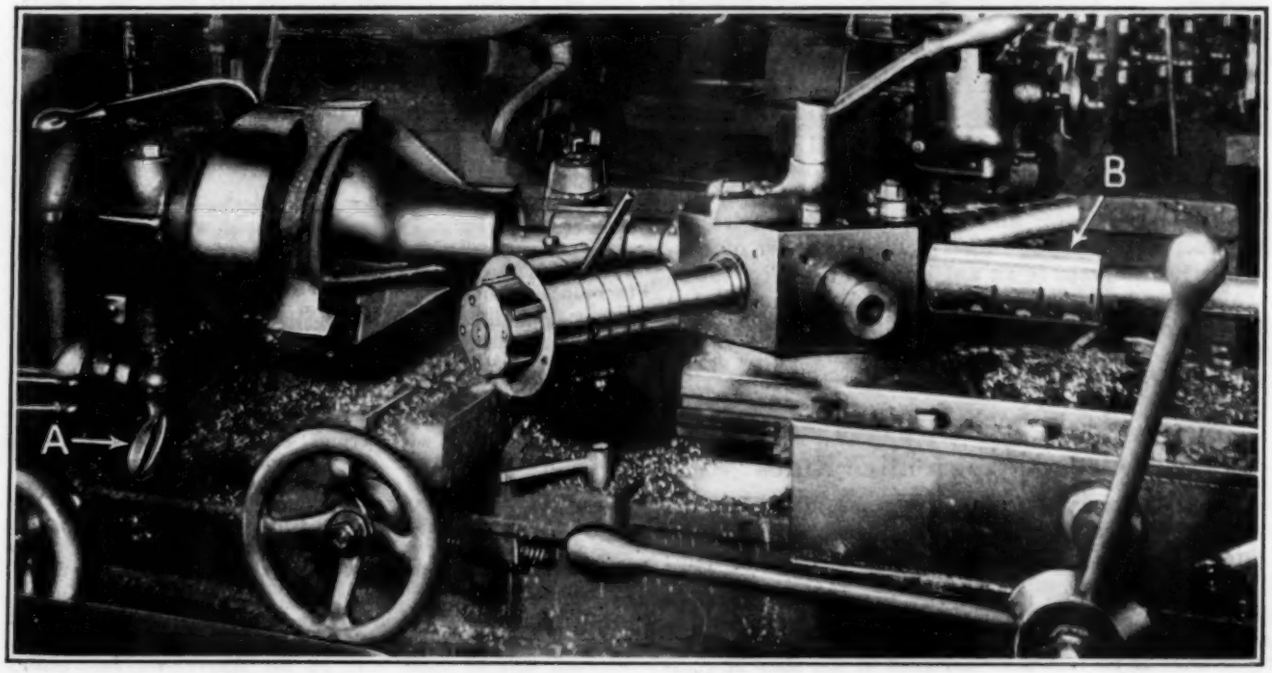
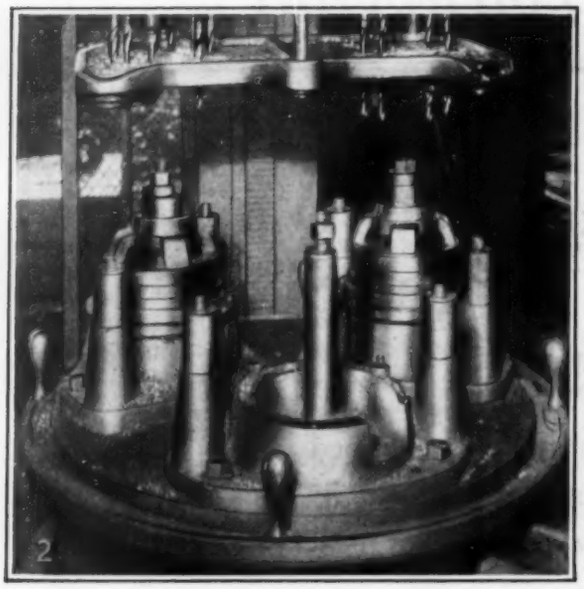


Fig. 1—Boring and threading housing

Automotive Production



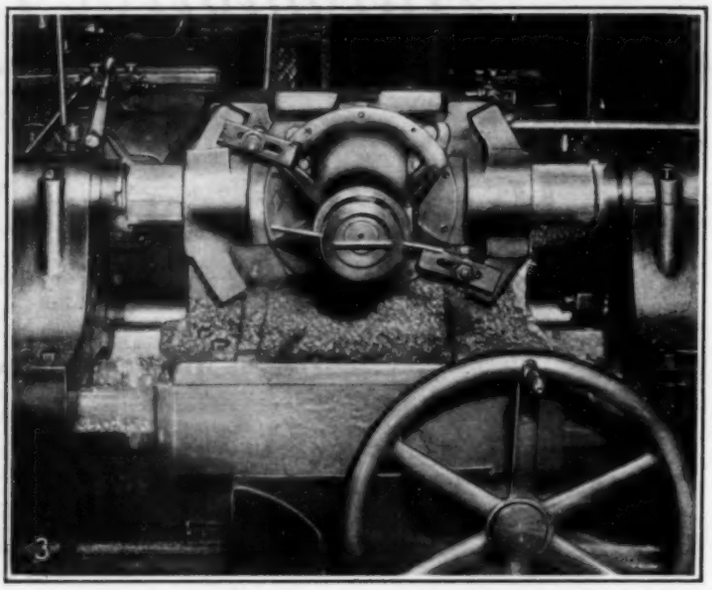


Fig. 2—Fixture for housings and carriers. Fig. 3—Cross-boring for axle bearings

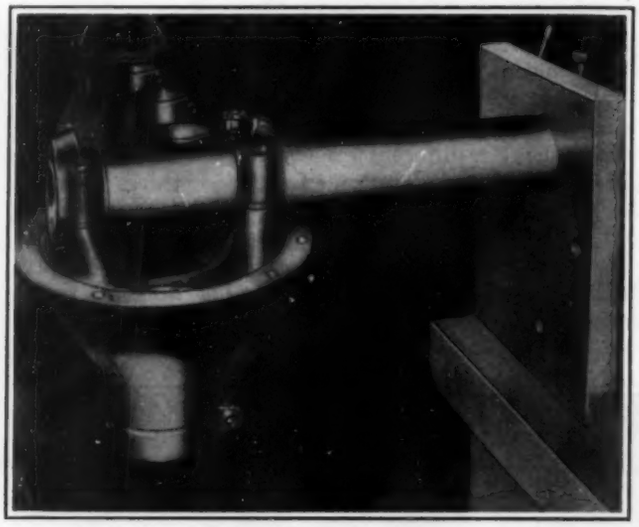


Fig. 4—Hand reaming for bearings

order to insure proper alignment. The cross holes are then line reamed in the rather unusual manner of having the reamer fixed in an angle plate as in Fig. 4, and turning the housing by hand. The long bar reaches through into the second bearing before the reamer begins to cut and so guides the work while a very small amount is being reamed out to secure the proper size.

Rio Grande Apprentice Rules

The following rules and regulations governing the employment and training of apprentices are in force on the Denver & Rio Grande Western Railroad System:

1. Requests may be filed at any time for the privilege of serving a course of apprenticeship, and will be taken under advisement by the Apprentice Instructor, or, in the event there is no Instructor assigned at the shop in question, by the General Supervisor of Apprentices.

2. When it is deemed advisable to effect the employment of either regular or helper apprentices, applicants will be required to submit to an examination by the Apprentice Instructor *prior* to assignment as either a regular or helper apprentice.

3. After the applicant has satisfied the Apprentice Instructor, the latter will direct the former to report to the Master Mechanic or other officer in charge, who will arrange to make all necessary arrangements in connection with employment.

4. After the application has been properly accepted, the Apprentice Instructor will consult with the General Foreman to make certain that the apprentice is properly assigned and started upon the field of endeavor he has selected to master.

5. The Apprentice Instructor will be responsible to see that the working schedules designed and approved to govern the training of the apprentices are adhered to and will report on such matters to E. J. Santry, General Supervisor of Apprentices, who has been designated by the General Mechanical Superintendent.

6. Various progress reports covering each individual apprentice will be submitted by the local Apprentice Instructors to E. J. Santry, General Supervisor of Apprentices.

7. Arrangements will be made to have apprentices in each craft attend classes two hours each week, on company time, and attendance *will be compulsory*. Class rooms may be discontinued at any time when it is deemed necessary to reduce expenses.

8. Examination of apprentices by the Apprentice Instructor will be held as often as is designated by the General Supervisor of Apprentices.

9. Rules contained in the A. of M. C. H. & A. agreement governing apprentices will be fully recognized.

10. These rules will become effective at once and all apprentices, regardless of experience gained prior to employment as apprentices, must serve full time as provided in the A. of M. C. H. & A. agreement; no credit to be extended for time served in outside industries or on other railroad properties, except as regards reduction of full time to three years as provided in the A. of M. C. H. & A. agreement.

11. Apprentices considered lacking the necessary aptitude or attitude to properly master the trade they have selected, will be dealt with by the *Apprentice Instructor* in a manner most profitable to both the Company and the individual involved.

Gear Teeth in Action

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Planetary gear trains, continued—Speed and load problems solved for various forms of spur and internal planetary gear trains—Differential and variable-speed gear trains

ONE of the most compact arrangements of a planetary gear train employs an internal gear for one sun gear and a spur gear for the other, with but one planetary pinion that meshes with both sun gears. Either sun gear may be fixed. Generally, however, the internal sun gear is the fixed gear. In Fig. 20 is shown one construction of this type of planetary gear train with the internal sun gear as the fixed one. In this example,

F = fixed sun gear
S = moving sun gear
P = planet pinion meshing with both sun gears
A = arm which carries the planet pinion.

We will first determine the reduction ratio of such a train. The analysis is made in the same manner as before. In the construction shown, the sun gear S is the driving member while the arm A is the driven member. As it is always simplest to determine the speed ratio between the two shafts when the arm A is the driving member, we will first consider, this arm as driving. With all of the gears locked together and revolved for one turn, the driven shaft will make one revolution in the same direction as the driving member. Then with the arm A locked, and the fixed sun gear F revolved backwards for one turn to restore it to its original position, the sun gear S will move in the opposite direction, or further ahead, in the direction of rotation of the driving arm A, an amount that depends upon the reduction or ratio between S and F considered as a simple train. This amount is equal to $\frac{F}{S}$ Whence the speed ratio when the arm A is driving is equal to $1 + \frac{F}{S} = \frac{S+F}{S}$. When the sun gear S is the driving member the reduction ratio will be the reciprocal of this, or equal to $\frac{S}{S+F}$. With this construction, the driving and driven shafts always turn in the same direction.

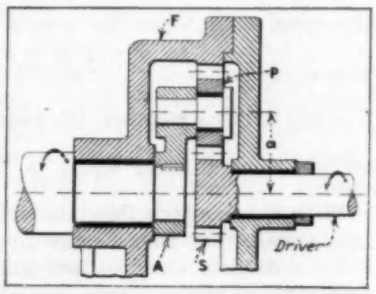


Fig. 20—Simple form of planetary gear train

As a definite example we will determine the reduction ratio of a planetary gear train as shown in Fig. 20 with the following values:

F = 12.000 in.
S = 2.000 in.
P = 5.000 in.
a = 3.500 in.

$$\text{Reduction ratio} = \frac{S}{S+F} = \frac{2}{2+12} = \frac{1}{7}$$

We will now consider the tooth loads on this type of planetary gear train. In Fig. 21, a diagram of such a train is shown.

As before, the action between these gears can be compared to a simple lever. In effect, the pitch point on the fixed sun gear F is the fulcrum, while the load is applied at the pitch point of the moving sun gear S to force the center of the planet pinion P ahead. At the right in Fig. 21 is shown a diagram that represents these conditions. The force W_1 is the driving force, W_2 is the tangential load at the center of the planet pinion P which acts against the carrying arm A to force it ahead, while W_3 is the pressure against the fulcrum at the pitch point of the fixed sun gear F. As forces W_1 and W_2 are acting in opposite directions, the pressure W_3 is equal to their difference. We have from the diagram in Fig. 21:

$$W_1 \times l = W_2 \times m$$
$$W_3 = W_2 - W_1$$

As l is the diameter of the planet pinion and m is its radius, $l = 2m$. Whence

$$W_2 = \frac{l}{m} W_1 = 2W_1$$
$$W_3 = W_2 - W_1 = W_1$$

When the power and speed requirements are known, these loads may be readily determined. Thus when

S = pitch diameter of the driving gear
V = velocity in ft. per min. of point of application of driving force.

$$V = \frac{S \times \text{r.p.m.}}{12} = 0.2618\, S \times \text{r.p.m.}$$

$$W_1 = \frac{33{,}000 \text{ hp.}}{V} = \frac{126{,}050 \text{ hp.}}{S \times \text{r.p.m.}}$$

As a definite example, we will assume that the foregoing example of this type of planetary gear train is

The seventh article. The eighth will appear in an early issue.

to transmit 2 hp. when the driving shaft revolves 1,200 rev. per minute.

$$W_1 = \frac{126{,}050 \times 2}{2 \times 1{,}200} = 105.04 \text{ lb.}$$

$$W_2 = 2W_1 = 210.08 \text{ lb.}$$

$$W_3 = W_1 = 105.04 \text{ lb.}$$

The reduction ratio is 1/7, whence the speed of the driven shaft will be 1/7 of 1,200 or 171 rev. per minute.

The pitch-line velocity of engagement on the fixed sun gear F will be equal to $0.2618 \times F \times 171 = 537$ ft. per minute.

The pitch-line velocity of engagement on the sun gear S will be the same as that on the fixed sun gear F, as the same pinion meshes with both, whence the same number of teeth, or length of pitch line, must come in contact with both mating gears in the same interval of time.

With a tooth load of 105.04 lb., the potential power transmitted by the gear teeth is equal to $105.04 \times 537 = 56{,}406$ ft.-lb. per min. This is slightly less than the actual power transmitted (66,000 ft.-lb. per min.),

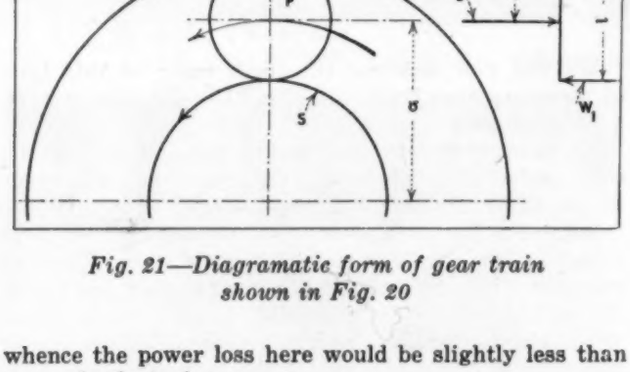


Fig. 21—Diagramatic form of gear train shown in Fig. 20

whence the power loss here would be slightly less than on a simple train.

This construction of a planetary gear train, using a spur gear and an internal gear for the sun gears, is the only one that will compare favorably, as regards tooth friction power losses, with simple trains. The reduction ratios that can be obtained on this type of planetary train are very much smaller than those that can be obtained on other types; about 10 to 1 is the greatest ratio that it is practical to use, and even this ratio requires the use of a planet pinion several times as large as the spur sun gear. This type of planetary train may also be constructed with a double planet pinion, the one meshing with the spur sun gear while the other meshes with the internal sun gear. In Fig. 22, such a construction is shown.

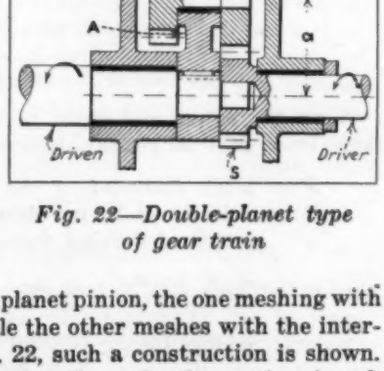


Fig. 22—Double-planet type of gear train

We will first determine the reduction ratio of such a train. This is accomplished in the same manner as before. In the construction shown, the sun gear S is the driving member, while the arm A is the driven member. As it is always simplest to determine the speed ratio between the two shafts when A is the driving member, we will consider this arm as driving and proceed as before.

With all of the gears locked together and revolved for one turn, the driven shaft will make one revolution

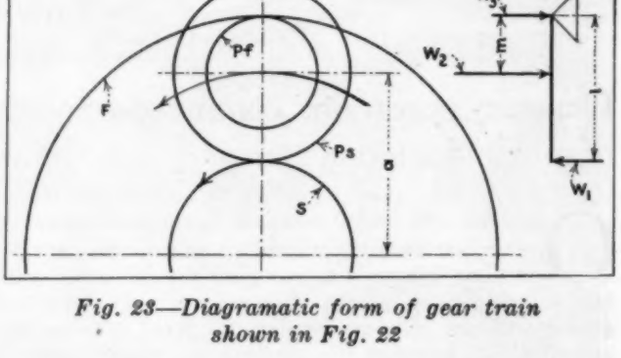


Fig. 23—Diagramatic form of gear train shown in Fig. 22

in the same direction as the driving shaft. Then with the arm A locked and the fixed sun gear F revolved backwards for one turn to restore it to its original position, the sun gear S will move in the opposite direction, or further ahead in the direction of rotation of the driving shaft, an amount that depends upon the ratio of the gear train between them considered as a simple train. This amount is equal to $\frac{F \times Ps}{Pf \times S}$. Whence the speed ratio when the arm A is driving is equal to $1 + \frac{F \times Ps}{Pf \times S} = \frac{Pf \times S + F \times Ps}{Pf \times S}$. When the sun gear S is the driving member, the reduction ratio will be the reciprocal of this, or equal to $\frac{Pf \times S}{(Pf \times S) + (F \times Ps)}$.

With this construction, the driving and driven members always turn in the same direction.

As a definite example, we will determine the reduction ratio of the planetary gear train shown in Fig. 22 with the following values:

$F = 10.000$ in.
$S = 2.000$ in.
$Pf = 3.000$ in.
$Ps = 5.000$ in.
$a = 3.500$ in.

$$\text{Reduction ratio} = \frac{Pf \times S}{(Pf \times S) + (F \times Ps)} = \frac{3 \times 2}{(3 \times 2) + (10 \times 5)} = \frac{3}{28}$$

We will now consider the tooth loads on such a planetary gear train. In Fig. 23, a diagram of such a train is shown.

As before, the action between these gears can be compared to a simple lever. In effect, the pitch point on the fixed sun gear F is the fulcrum, while the load is applied at the pitch point of the sun gear S to force the center of the planet pinions ahead. At the right in Fig. 23 is shown a diagram that represents these conditions. The force W_1 is the driving force, W_2 is the tangential load at the center of the planet pinions, while W_3 is the pressure against the fulcrum at the

pitch point of the fixed sun gear F. As forces W_1 and W_2 are acting in opposite directions, the pressure W_s is equal to their difference.

$$W_1 \times l = W_2 \times m$$
$$W_s = W_2 - W_1$$

From the diagram in Fig. 23 we have:

$$m = \frac{Pf}{2} \quad \text{and} \quad l = \frac{Ps + Pf}{2}$$
$$W_2 = \frac{l}{m} W_1 = W_1 \left(\frac{Ps + Pf}{Pf}\right)$$

When the power and speed requirements are known, these loads may be readily determined. The value of W_1 is determined in the same manner as in the preceding example.

As a definite example, we will assume that the foregoing example of this type of planetary gear train is to transmit 2 hp. when the driving shaft revolves 1,200 rev. per minute.

$$W_1 = \frac{126{,}050 \times 2}{2 \times 1{,}200} = 105.04 \text{ lb.}$$

$$W_2 = W_1 \left(\frac{Ps + Pf}{Pf}\right) = 105.04 \left(\frac{5+3}{3}\right) = 280.11 \text{ lb.}$$

$$W_s = W_2 - W_1 = 280.11 - 105.04 = 175.07 \text{ lb.}$$

The reduction ratio is 3/28, whence the speed of the driven shaft will be 3/28 of 1,200 or 129 rev. per minute.

The pitch-line velocity of engagement on the fixed sun gear F will be equal to $0.2618\,F \times 129 = 338$ ft. per min. The corresponding pitch-line velocity on the moving sun gear S will be equal to $338 \times \frac{Ps}{Pf} =$ 563 ft. per minute.

With a tooth load of 105.04 lb., the potential power transmitted from the sun gear S to its mating pinion will be equal to $105.04 \times 563 = 59{,}138$ ft.-lb. per min. This is slightly less than the actual power transmitted.

With a tooth load of 175.07 lb., the potential power transmitted from the planet pinion Pf to the fixed sun gear F will be equal to $175.07 \times 338 = 59{,}174$ ft.-lb. per min. which is also less than the actual power. The tooth friction losses here will also be slightly less than for a simple train.

Differential gear trains are seldom used for the continuous transmission of any large amounts of power. Usually they are employed either as a compensating device, such as in a rear axle drive for an automobile, or to obtain small corrections of position, such as in some instruments and on some machine tools. Occasionally, however, they are employed for the continuous transmission of power, and in such cases the tooth loads, velocity of tooth engagements, and potential power transmitted should be carefully analyzed because generally the potential power handled here is very much greater than the actual power transmitted.

The design of differential trains depends primarily upon the duty they have to perform. Sometimes they are in the form of a planetary gear train, but with both sun gears movable. At other times they appear as simple trains, and the large amount of potential power that must be handled is not always self-evident, and is easily overlooked. Fig. 24 shows an example of this kind.

This drive was required to impart a relatively slow movement to a spider carrying scrapers which operated inside of a revolving barrel or drum. The drum is about 16 in. in diameter and revolves about 800 r.p.m., while the scrapers revolve about 798 r.p.m., or 2 r.p.m. in relation to the drum. The actual power required to operate the scrapers is about 1 hp. The gears used in this train were all nearly the same size, which was about 10 in. in diameter. For example, with 27 teeth in A, 28 teeth in B, 30 teeth in C, and 29 teeth in D, the speed ratio between the shaft driving the drum and the sleeve driving the scrapers would be $\frac{A \times C}{B \times D} = \frac{27 \times 30}{28 \times 29} = \frac{405}{406}$. Thus when the gear A revolves 800 r.p.m., the gear D which is fastened to the sleeve that drives the scrapers would revolve very closely to 798 rev. per minute.

The first construction of this gear train made no allowances for the high potential loads carried. In operation, the gears were completely destroyed in a

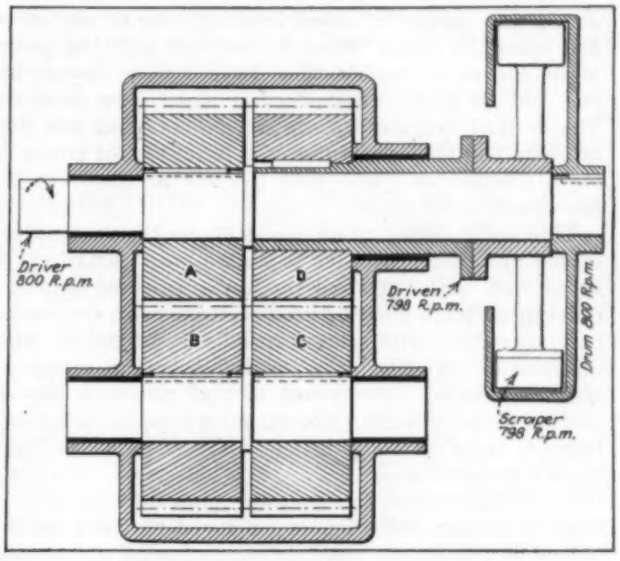


Fig. 24—Differential gear train where potential power is large

very few minutes. The next set was made without a definite analysis of the conditions, but were made heavy enough to carry about 75 hp. as a simple train. Superficially this seemed ample, as the whole unit was driven with a 10-hp. motor, and the scrapers had but 1 hp. of actual work to perform. This set in operation showed rapid wear, while the heating of the gear case was so excessive that the unit could not be run under load for much more than one hour at a time. In commercial operation, this unit was to be operated nearly 24 hr. per day. In addition, the friction losses were so great that full speed could not be obtained from the motor even when it was overloaded to the point where it developed nearly 13 horsepower.

The following analysis made apparent the cause of the difficulties. The mean diameter of the scraper blades is about 14 in., the speed of these scrapers in relation to the drum is but 2 r.p.m., giving them a working velocity of 7.33 ft. per min. The load on these scrapers, when performing work equivalent to 1 hp., thus became about 4,500 lb. The pitch diameters of the gears were about 10 in., whence the tooth loads on these gears would be approximately $\frac{14}{10} \times 4{,}500 = 6{,}300$ lb. The

pitch-line velocity of tooth engagement on these gears, revolving together at about 800 r.p.m., is about 2,100 ft. per min. Whence the potential power transmitted by each pair amounts to $6,300 \times 2,100 = 13,230,000$ ft.-lb. per min., or about 400 hp. The differential speed is about 1 rev. in 400, and the potential power increases over the actual power practically in direct proportion, a condition which is very similar to many planetary gear trains. The power loss here due to tooth friction, if one per cent of the potential power amounts to 4 hp. on each pair, making a total of 8 horsepower. In this case the input must be 9 hp. while the output is but 1 hp. of useful work.

This gear set was redesigned to handle 400 hp. in each pair and the case was redesigned to dissipate 8 hp. in heat. The unit then ran successfully.

For years inventors have been seeking a way to arrange a mechanical toothed gear train so that with a constant-speed driving member it would be possible to obtain any change of speed from zero up to any specified speed in either direction without shifting gears. Many ingenious combinations have been proposed, but one and all prove unsatisfactory upon close analysis. The desired range of speeds can be obtained, but they are obtained at the expense of a large loss of power in tooth friction and also give too low a torque at the low speeds to be useful.

This result seems to be inevitable by the very nature of the problem. In order to obtain such variations in speed with gears of fixed tooth-numbers and ratios, a differential train must be used somewhere in the combination together with some form of friction drive. This differential, in effect, acts as the beam of a pair of weighing scales. The result is high potential powers and low actual powers. The output will be the difference between these partially balanced forces, minus a large tooth friction loss.

All of such drives develop into uniform-torque drives. Usually a gear reduction is employed to build up the torque at low speeds. A friction-controlled differential drive of this sort has its torque limited by the tooth load that the differential combination can carry. This load is practically constant, and the mechanical advantage between this differential and the final drive is also constant: hence the maximum torque at the final drive is practically constant at all speeds. To make the parts of such a combination rugged enough to carry a large torque at low speeds would involve such a cumbersome unit that it would be impractical. Or, to put it another way, the same gears used in a simple gear train could transmit far more power than when arranged in combination with such a variable-speed, differential train.

The writer will not go so far as to say it cannot be done—that is too broad and sweeping a statement. To date, however, he has never seen any such a combination that was efficient enough to justify its construction. If such a variable speed control is necessary, there are other better and simpler ways of obtaining it more efficiently.

Don't tell a man it's a good job, if it isn't. It is better to point out its defects in a kindly and constructive manner than to make him believe you think it is good. But on the other hand, when the man does a good job tell him so. He'll appreciate it all the more because you showed him where the other could be improved.

Climbing Out of the Rut—Discussion

By Lawrence F. Swenson

In the *American Machinist*, on page 517, Vol. 65, Entropy paints a gloomy picture of the machinery industry, and apparently thinks it is dominated by a lot of old fogies. He holds up the electrical business as a glowing example of progress and development, against which the modern machine tools cannot begin to be compared. He suggests the elimination of this deplorable condition by putting some smart young men to work, who never saw a machine, and let them design something really new and scientific.

To my way of thinking, any large industry, whether electrical or mechanical, is continually in a state of development. It is admitted that the electrical business has progressed more rapidly than the machine industry, but its existence as a major industry has been during a fast moving age. It did not have to carry the load known as tradition. Conservatism and tradition were much more prevalent years ago than during the last decade or two.

The machine business is an old timer, but is by no means standing still. Until the time high-speed steel was developed, there was little call for machinery of modern design. The modern high-powered machines with direct-connected motors would have been unwieldy giants without high-speed steel. Again, if the electric-motor had not been developed, what justification would high-speed steel have for its existence? Surely, belt drives of sufficient size to drive a battery of modern machines would be rather cumbersome.

Another point worth bringing out is that no man should ridicule or run down his own business. With probably thirty years yet to spend in the mechanical field, I, and many other young engineers, like to feel that our choice has been a good one. To read an article like the one referred to is not encouraging, especially when a man who has been through the mill comes out and states that our chosen line is terrible.

Experience—Whose Is It?—Discussion

By John Mark May

Entropy's query about the rightful ownership of experience under the above title on page 584, Vol. 65, of the *American Machinist* is interesting and timely.

The employer who keeps a man working at a salary beyond his worth with the expectation that the latter is going to develop into a more valuable servant and that he, the employer, will derive the benefit in the days to come, as well as the employee who sticks to a job at low pay just because he thinks there is a chance of getting eventually the salary that he is earning, are both counting chickens that may not be hatched.

However, no workman's pay should be figured entirely by the amount of cold cash that he receives in his pay envelope. The experience that he is receiving may add very materially to that amount, as well as the contentment of mind and the healthful and pleasant surroundings.

There should always exist a gentleman's agreement that will not allow either a discharge or resignation to occur without sufficient notice for conditions to be readjusted properly. Beyond this I cannot see that either employer or employee can justly lay claim to the ownership of the experience of the other.

The Welding of Iron and Steel

By Comfort A. Adams
Director, American Bureau of Welding

Fusion welding developed within the last 40 years—The methods used—Automatic production machines for welding—Character of welds—Importance of trained operators

UNTIL about 40 years ago forge welding was the only known method of welding. The electric resistance method, invented at that time by Elihu Thomson, consisted in pressing together the parts, and passing a heavy current through until the joint reached the welding temperature. Further pressure was then applied to complete the weld. At first, resistance welding was applied only to simple parts such as wires and rods, but there are now many varieties of resistance welding under various distinguishing names, and which will be described.

The simple type of resistance welding is usually known as butt welding, and has been applied to widely varying shapes up to 36 sq.in. in cross section. The largest butt welding machine will weld on occasion, a cross section of 40 sq.in., and has a mechanical device which exerts 100 tons pressure on the joint. This great pressure refines the grain, and gives the weld the nature of a forging.

The author, who is an authority on welding, gives an outline of the chief methods now employed for the welding of parts, and the characteristic features of welding by electric resistance, electric arc, gas torch, and by the thermit method. He also draws some conclusions on the nature of the weld that can be expected from each process

In resistance welding, a heavy current is required for rapid heating, while a low voltage is used. This requires that the source of current be as close as possible to the jaws that hold the parts and transmit the current. To conduct the heavy currents any considerable distance would require an excessive amount of copper to prevent great loss of power.

In seam welding, the overlapping edges of sheet metal are passed between two narrow roller electrodes, and the speed, current and pressure are adjusted to produce a continuous seam weld. This method of welding is applied to the manufacture of barrels and tanks. Where air-tightness is not required, a lap seam may be welded in spots by clamping the seam overlap between two electrodes and passing the necessary current between them. As the electrical resistance of the surface contact is least in the region of pressure, most of the current is confined in this area, and a spot weld is made of about the same area as that of the electrodes. This method is called spot welding.

For the spot welding of plates heavier than $\frac{1}{2}$ in., the currents and pressures employed are very large, and considerable heat is developed at the surfaces of contact between the electrodes and the plates. Copper is the best material for the electrodes as it has a high thermal conductivity, but water cooling of the electrodes must be employed even with copper. Plates as thick as 3 in. have been spot welded successfully.

Much seamless tubing is made by resistance welding. An automatic machine takes a strip of steel, rolls it to form a tube, and welds the edges at a rate of from 60 to 150 ft. per min. At these high speeds the fusion is confined to a thin surface layer, and the flash or upset is hardly perceptible. With alternating current of 60 cycles per sec. the very high speeds result in an intermittent weld. This gives the appearance of a stitch, and at a speed of 120 ft. per min. the stitches would be 0.20 in. apart. For mechanical applications, such as bedstead tubing, this intermittent characteristic is not objectionable, but for an airtight tube slower speeds and higher frequencies of current must be used.

Electric arc welding is divided into several classes. In welding with a bare metallic electrode an arc is struck between a rod of suitable composition and the parts to be welded. The metal is fused at both ends of the arc, and the fused electrode is deposited in the joint. Most of the bare electrode welding is done with currents of from 75 to 200 amperes, and with electrodes about $\frac{1}{8}$ in. in diameter. At higher currents the arc sputters, and the weld is apt to be porous and contain gas pockets. Arc welding is done with direct or alternating current.

Coated electrodes are much used for arc welding in England. The coating serves as a fluxing or deoxidizing medium. Slag inclusions are likely to occur, however, unless the weld is done by a skillful operator. Arc welding in a reducing flame is accomplished by surrounding the electrode with a cylindrical jet of gas, which burns around the arc. Hydrogen, water gas, and alcohol vapor have been used for this purpose. The reducing flame serves the same purpose as the electrode coatings, with somewhat better results.

In carbon arc welding an arc is struck between a carbon electrode and the parts to be welded. The welding wire is then fed into the arc and fused into the joint.

Abstract of a paper presented at the fall meeting of the American Iron and Steel Institute at New York, Oct. 22, 1926.

This method requires the used of two hands as in gas welding, and differs from gas welding only in the source of the heat. A high rate of metal deposition is possible, but the quality of the weld is not equal to that of the best metallic arc welds.

Automatic machines are available for nearly all methods of electric welding. The advantage of the automatic welder is that the arc length and other variables are more accurately controlled than is possible with the most skillful hand operator. These machines are also great labor savers.

The process of fusion welding known as oxyacetylene welding is carried out by the heat produced by the burning of acetylene in the presence of commercially pure oxygen. The flame temperature attained is about 5,500 deg. F., which is high enough in a concentrated flame to melt any metal locally. In welding thick materials it is necessary to bevel the edges, and the V thus formed is filled by melting into it a rod of suitable composition. The weld metal is fused to the base metal. When the joint is made by a competent workman using proper materials it is clean and sound, and is usually as strong as the parts joined.

However, the ductility of an oxyacetylene weld is generally lower, and the yield point higher, than in the base metal. In other words, the weld is generally stiffer than the base metal. These different properties are of no importance provided that the stress is below the lower of the two yield points.

Thermit welding depends less upon the skill of the operator than the other processes. A thermit weld is made by providing a small gap between the fractured ends, surrounding these ends with a refractory mold, and pouring between and around the ends a highly superheated molted steel. This steel gives up its superheat to the parts to be welded, melting and solidifying them into one solid mass.

Thermit welding has developed in 20 years from a crude process to one in which every weld is perfect. The process is suited to small welding operations, but for light work it is more expensive than the oxyacetylene or electric processes. It is used principally in welding cast-iron or steel sections of more than 3 in. in thickness. One of the largest uses of thermit welding is that of rail welding in paved streets. In the thermit welding of cast iron, much of the iron is melted and alloyed with the steel, and the high-carbon content of the cast iron produces a high-carbon steel that is hard to machine. The weld, however, is stronger than the cast iron.

As compared with other methods of joining metals, no general statement can be made as to the cost of welding. In most cases welding of the type best suited to the job in hand results in a very considerable saving. On nearly all repair jobs, and in many production operations, the cost of welding is less than half that of other methods. Even between the costs of gas and electric arc welding no general statement can be made, as each case is surrounded by its own set of conditions and requirements.

For quantity work the gases for gas welding cost more than the electric power for arc welding, but in some cases a higher rate of deposition is possible with gas welding and the resulting saving in labor may balance the extra cost of the gas. In other respects gas and electric arc welding cover about the same field for iron and steel, but gas welding has given better results for cast iron.

The factors entering into the success of the applications of welding are numerous, and should be controlled by a man who is familiar not only with the practical part of the job, but also with the underlying principles. Many of the early failures that created a distrust of welding could have been avoided if this need of a supervisory welding engineer had been appreciated. The expertness of the welding operators can be tested only by physical tests of specimens of their work. Many welding experts recommend periodical tests of sample welds to check the skill of their welding operators.

Grinding Soft Rubber Tubes

By James Denton

A somewhat unusual job is the grinding of medium-soft rubber tubes 2½ in. in diameter by 3 ft. long. The object of grinding is to produce a uniform thickness of wall rather than for surface finish or exactness of diameter. A tolerance of 0.0025 in. was imposed in the matter of wall thickness.

The work was done upon a Norton 10x50-in., type A, cylindrical grinding machine. An 18x2-in. wheel of 20 grit Alundum, grade I, silicate bond, was used to grind the tubes, the grinding being done without water or other coolant. From 0.003 to 0.005 in. of material was removed from each tube. The wheel ran at a surface, or peripheral, speed of 6,000 ft. per min. The 2½-in. diameter tube was revolved at 140 r.p.m., and the table traverse was at the rate of 12 ft. per min., approximately. A production rate of 40 tubes per hour, including loading time, was maintained.

This latter statement would seem difficult of substantiation when one visualizes the trouble that would

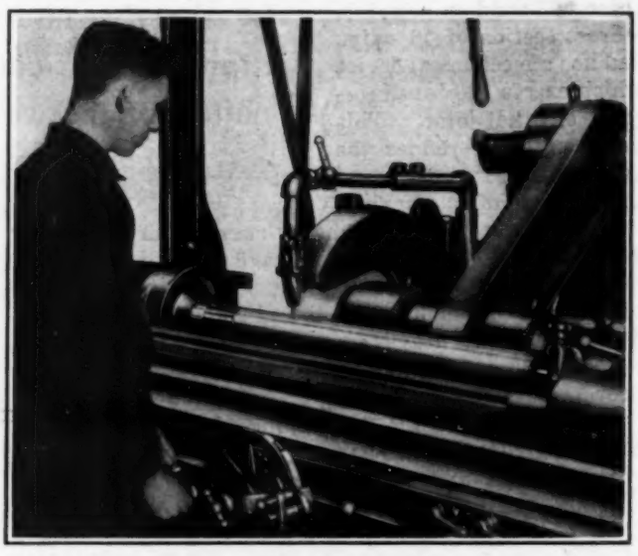


Fig. 1—Grinding a rubber tube

probably accompany the attempt to "wriggle" the close-fitting tubes over the mandrel, but right at this point there occurred to somebody one of those brilliant but ridiculously simple ideas that are always making the difference between failure and success upon experimental work.

The grinding operation is shown in Fig. 1, while in Fig. 2 is indicated the method by which the loading and unloading is done. In this case the operator is removing a tube from the mandrel. Though in the first

illustration the operator is shown with his hands on the controls of the machine, actually he seldom had to touch them. With a loaded mandrel on the centers, he merely engaged the clutch to start the table traverse and allowed the wheel to make one round trip, forward and back, over the work, during the time of which the grinding was completed.

The rate of table traverse was purposely so calculated as to require just about the same length of time as was consumed by the unloading and reloading operation,

Fig. 2—Floating the tube off of the arbor by compressed air

so that when the wheel ran out at the end of the return stroke the operator would have the second arbor reloaded and ready to replace the first upon the centers of the machine.

Forward adjustment of the wheel slide was necessary only at long intervals, since the wheel wear was almost negligible. A measurement would be taken over the diameter of each tube and when the size indicated approach to the high limit of the wall thickness the wheel would be advanced slightly.

To load the tube on the mandrel the operator would

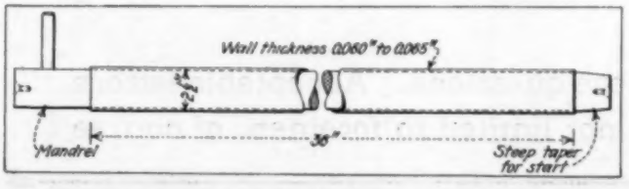


Fig. 3—Sketch of tube and mandrel

first draw the end of the tube down as far as it would go without offering undue resistance; a matter of three or four inches on the tapered end of the otherwise parallel mandrel. He would then fold over the opposite end of the tube and roll it tightly upon itself, causing the entrapped air to swell the tube and allow it to be drawn still further upon the mandrel.

This would be repeated two or three times, or until the tube was within a few inches of the correct position on the mandrel. The operator would then insert the nozzle of an air gun between the tube and the mandrel at the leading end of the tube and shoot in a jet of air; which would have the effect of swelling the tube away from the mandrel so that it could be drawn over the remaining distance without trouble. After acquiring the "knack," the operation was quickly performed.

Withdrawing the tube from the mandrel was accomplished by the same means. The gun would be inserted between the mandrel and the tube by stretching the rubber slightly with a screwdriver. Pinching the wall of the tube between his thumb and the nozzle of the gun, the operator would shoot a jet of air into the tube, causing it to swell away from the mandrel so that it could be drawn easily for a short distance. As soon as the end was clear of the mandrel, so that the rubber could be pinched about the nozzle of the gun to hold the air, the rest of the withdrawal became very easy, the rubber being held practically out of contact with the mandrel by the air pressure.

The Psychological Moment

BY JOHN HOMEWOOD

Beads of cold sweat formed upon my forehead as I proceeded with my drawing. The thought had come to me that it was time that the boss recognized my services, in the matter of more pay. I tried to summon courage to approach him, but at the critical moment my heart failed me.

At the time I was tracing one of those "breakneck-speed" jobs. "Opportunity knocks but once," I heard the little voice say within me, so I started to make a grand showing. The boss paced around occasionally to see how things were progressing. I was setting an engineering record for speed and technique. As I checked the tracing for errors my blue pencil left check marks behind with rhythmical staccato.

"Nearly ready with that tracing, Homewood?" queried my impatient boss.

"Just a second, I'll have it out in a jiffy," I replied in subservient fashion, and hurriedly extracted the thumb tacks. "I'll clean off the check marks, and then you can have it."

"After he gets this job he will realize what a wonder I am," I chuckled to myself as I reached under the table for the bottle of gasoline. "This is my hour," I mused, as I poured the fluid onto the cleaning rag. "It is the psychological moment."

The muscles of my arm tightened in grim determination. With glowing anticipation I rubbed and rubbed in utter abandon with that rag, soaked with alcohol! Some silly jackass had replaced the bottle of gasoline with a bottle of the forbidden fluid, resulting in the total destruction of my drawing. My mental and physical greatness slowly receded as my ego took to the wings of despair. Needless to say, I postponed my application for a raise.

THE · FOREMAN'S · ROUND · TABLE

Making Good Workmen Out of Poor Prospects

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAY, Al, you've sure got a booster in that man Schimmel. Came in on the train with him this morning and he sang your praises all over the scale. Said you'd boosted him without his asking for a raise and given him a chance to show what he could do. What's the answer, Al? He's a sour looking bird—how did you come to pick him to coddle?"

"Coddle nothing, Ed. You know me better than that. It's a funny case about Schimmel. He was dumped on me from another department with a rep that would have hung a dog. As you say, he's a sour looking bird and I didn't think he'd last over a week. I was ready to fire him the first time he stepped over the chalk line. But he didn't step.

"He tackled any sort of a job I gave him, no matter how dirty, and he didn't kick. What's more, he did it well, Ed—and came back for more. So I began to study him a bit and to try him out on other and better work. And say, Ed, he's the most willing worker I've got and he's always on the job."

"How do you figure it out, Al?"

"I haven't tried very hard. But I guess you can lay it largely to his personal appearance. I might have fired him the first day and never have known that I'd let a good man go. There's a lot depends on chance, Ed, whether we like to admit it or not."

"But what about the raise?—he would have stayed at the old rate, wouldn't he?"

"Yes, I guess he would. But he was getting a very low rate and when he began to make good I felt it was only fair to boost him a little. And I've found that a dollar given without asking goes as far as two that come grudgingly. The two dollar raise I gave him is worth double to the company. It's the first encouragement he's had and he sure did appreciate it. He's doing much better work than some of the men getting more money and he's always dependable. He probably hasn't foreman stuff in him because of his appearance and disposition. But as a worker, he's a dandy—and there'll be trouble if some one tries to take him away from me."

"You may be right, Al. But I don't believe it's necessary to raise a man before he asks for it. What's worth having is worth asking for. And this developing rough ducklings isn't in my line. I don't believe I'm good enough at it to make it worth while."

Was Al wise in raising Schimmel's pay voluntarily?
How much do personal appearance and disposition affect a man's chances in the shop?
Does it pay to spend time developing unpromising men or boys?
How far can a foreman go in giving his men a chance to develop?
Does a man with a poor personality get a square deal?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Keeping Machines on the Job

BREAKDOWNS of machines in factories can be reduced to a minimum by teaching the boys and recruits how, when and where to use the oil can, the screwdriver and the wrench. The systematic use of the oil can and the periodic adjustment of bearings, screws and nuts is far better and cheaper than allowing a machine to run itself down until it needs a complete overhauling.

In large plants I find that the best method for repairs is to have a repair man under the supervision of the toolroom foreman. He will usually allocate a man to each department to carry out minor repairs and to fill in the remainder of his time with the other men who are repairing machines that require complete overhauling. The repair man can be of great assistance to the foreman of the department to which he is assigned inasmuch that each time a machine is being tooled up, it will be his duty to tune it up. In this way every machine will come under the care of the maintenance man and its condition is known to him and to the department foreman. Whenever a machine is in need of new parts the maintenance man will report to the toolroom foreman.

It is all right to have maintenance men under the care of the department foreman in the small shop where the man can also take care of countershafts and auxiliary equipment but in large firms producing work on mass production lines it is far better to have the maintenance man work under separate supervision.—C. L. HENRY, *England.*

Keeping Machines on the Job

BREAKDOWNS can occur under the best of supervision but can be reduced by careful inspection of the machines and their products. In many cases, symptoms can be found of parts that are wearing and need adjustment or replacement. These, if promptly attended to, may save much time and expense.

When these symptoms of worn parts appear, particulars should be taken and new parts made at once. Then, when it is convenient for the machine to stand idle, the replacements can be made.

The repair man should not be independent of the foreman. His work is to repair the machines so as to give the foreman the required results and if he is independent there are many cases where this cannot be achieved. Much better results can be secured if the repair man is under the foreman since the latter knows what his machines should produce and when his products are due to be delivered as well as what and how much work is to follow. Being conversant with all these details, he can authorize the maintenance man to inspect and to repair machines according to the course of operations.—H. HAYGARTH, *England.*

How Much Standby Equipment Is Necessary?

THE question as to how much standby equipment is necessary, raises a most important point, both from a financial and production point of view. Of course, this question will depend on what kind of products are being manufactured.

Ours being a general engineering shop, we have to deal with very wide and varied demands. Since we have upon our catalog some 300 to 400 different sizes of engines and machines for as many different purposes, and are receiving orders frequently on very short notice, the question as to the amount of standby equipment that is necessary becomes very important.

My own practice is to always keep each machine working. As standby equipment, I have the hacksaw, a couple of small drilling machines, a small milling machine and a couple of old lathes, one of which has a very deep gap bed that sometimes comes in handy for handling large pulleys and flywheels. I always look upon such men, for reserve, as the one that sweeps the shop, the move men, or the one that operates the hacksaw.

If one of the regular men is out sick, it is encouraging to the ones receiving lower pay to work their way up to better standards.—H. MAPLETHORPE, *England.*

Getting Information from Catalogs

TEXT books give us a great deal of information in a general way about the work that machine tools are best adapted to do, but it is beyond their sphere to go into details of the specific improvements that each manufacturer builds into his tools. The different products of various manufacturers will all have some characteristic which will make them particularly suited for a particular job. The foreman is greatly helped in the selection of the machine that is best suited for the job he wants to do, if he studies the catalogs published by the manufacturer.

A well prepared catalog should specify the weight, floor space occupied, and the power required by the machine. It should specify the minimum and maximum

THE · NEXT · TOPIC

Cutting Down Unnecessary Repair Costs

QUESTIONS

What can be done with the careless workman who is responsible for machine breakdowns?

What provision should be made to prevent interruption of production when such an accident occurs?

Is the group bonus that can be penalized a solution?

THE · FOREMAN'S · ROUND · TABLE

capacity, the speeds and feeds, the accuracy and possibilities on heavy work, the provisions for coolant, for oiling, cleaning and for making repairs, as well as such features of safety and simplicity of operation that the machine possesses. It seems needless to say that the price should be shown.—JOHN MARK MAY.

Letting a Man Try His Own Way

OBVIOUSLY, Ed is adopting a wrong attitude by ignoring Jimmie's suggestions for doing work. Every foreman owes it to the firm that employs him to see that production times on each job are cut to the minimum. Since no foreman can be expected to know all the best ways for doing jobs, the foreman is doing his duty only when he is co-operating with his men. If it was otherwise, there would be no need to ask the men for suggestions in order to lower the cost of production.

As Al points out, it is the business of every foreman to run his department in a manner that is calculated to obtain maximum production. By letting a man try his own way his interest in the job will be increased and he will strive to get maximum production in order that he may be able to prove to his foreman that his actually is the better way.

There is no question of sacrificing discipline in allowing a man to do a job his own way if his way is more efficient than the shop method used. To be a foreman a man should lead his men and should thus be able to convince a man if his method is inferior to that previously used.—JAMES C. HARPER, *Scotland.*

Picking Assistants

WHEN selecting an assistant foreman, Ed should have before him a record of the men including their length of service with the company, ability on the job and also their attitude towards their fellow workers. He should make his selection, if possible, from those already in the employ of the company so that the men will have a definite goal toward which to work.

Ed's aim should be to organize his department to meet all emergencies. It must be in such a condition that Ed can be absent and still find his department carrying on as if he were there.—A. F. TAYLOR.

Picking Assistants

FOR his assistant, Ed should pick Jim Brown in spite of the fact that Jim made a mess of the repair job on which he was sent. It is not likely that the will make the same mistake again and since, as Ed says, he votes a "straight ticket" he is the type of man who would be appreciated by his fellow men and respected as a level-headed leader.

Ed should not keep a record of a man's work, neither should he go by what he remembers. He is called upon to make an important decision, therefore he must consider the general personality and ability of the man in question.

It is always wise to have men ready to keep things running in case the foreman is away. The man who cannot be away without finding things in a mess when he returns must consider himself a poor organizer.

Ed is not justified in being afraid to pick an assistant. If the boss was not satisfied with Ed he would not be likely to ask him to select a deupty but would do so himself. If Ed has a capable assistant he is more likely to be chosen for a bigger job when the opening comes, since there will be someone ready to step into his own shoes and he can be spared from his department.—W. MAKINSON, *England.*

Picking Assistants

SELECTING the right man for your assistant is not always an easy task. Merit, of course, must be the first consideration; length of service should be a factor only when other things are equal.

Before you select a man as assistant, you should know what qualities to look for in him and be able to analyze his general fitness for the position. Being a good judge of human nature is not enough. That is guesswork and it is inaccurate. Neither is personal liking for a man a good reason for choosing him.

Perhaps the three qualities essential to good assistants are vision, initiative and conviction. Too many rely exclusively on common sense to carry them through.

When picking a man that has made mistakes we should remember that it can be said that no man has mounted the first step to achievement who has not learned to make mistakes nobly and to retrieve them gracefully.

Hasty decision based upon the idea that one man is as good as another is entirely wrong. A foreman who is burdened with many other duties and lack of time, may not be able to keep full records but he should have a record of some sort when it comes to picking a man for so important a position. This need not be elaborate but it should permit the forming of a correct opinion of the man.—JOHN R. NIKOLAIS.

Picking Assistants

ED SHOULD pick his assistant from the men in his own department. If he chooses a man from the outside there will be less co-operation in the department and there will be little incentive to encourage the efforts of the men. If there is no competent man in the department he should choose one from some other department in the shop.

Records should be kept of the work of all the men, and they should be used in the picking of an assistant. It is not just nor fair to the candidates for the position of assistant foreman to trust to memory alone. Ed will be the loser if he continues in the department without an assistant.—JOS. E. ABBAZIA, *Mechanical Instructor.*

Ideas from Practical Men

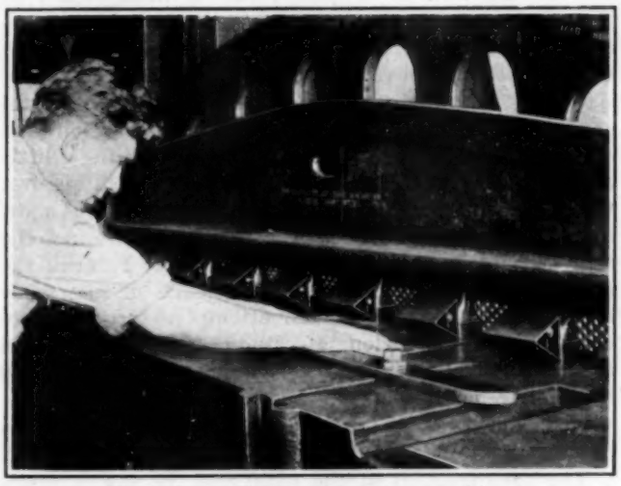
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Safety Guards for Metal Shears

By Joseph Hewes

The illustration shows safety guards for power shears, developed at the Baltimore plant of the General Electric Company.

Each clamp finger is provided with an automatic floating guard which normally rests on the machine table. While these guards prevent the operator from putting his fingers under them, they offer but little



Guards applied to shearing machine

obstruction to the placing of the sheet to be sheared. In addition to the guards on the clamp fingers, a perforated guard is placed between the clamp bar and the knife. This guard is ¾ in. away from the knife and extends the whole width of the machine, the ends being fastened to the uprights. The perforations are large enough to allow the operator to see that the stock is placed in the proper position for cutting.

Make it Easy to Find Change Gears

By Walter Jones

Many times the figure designating the number of teeth in a change gear is obliterated or difficult to read, rendering it necessary when selecting the gears for a certain thread to count the teeth; a proceeding that results in considerable loss of time. It occurs to the writer that a rule might be made with the graduations so placed as to indicate the number of teeth in the gear directly when the rule is placed across the diameter. It would be necessary to have a rule for each pitch.

Another scheme to simplify the selection of change gears is to make a cabinet to contain the set, with a compartment to receive each individual gear without extra space. This would insure that the gear selected would correspond to the number of teeth indicated by the tag above or below the compartment.

In many shops the change gears are merely hung on pegs driven into a board that is nailed up in some place convenient of access. In such case, a circle of headless nails driven into the board to surround each gear as it hangs on its peg will keep it in the place to correspond with the designating number stamped or branded on the board above or behind the gear.

Test Table for Superheater Sections

By L. L. Locke

At the Soo Line shops, Minneapolis, Minn., superheater-flue sections are inspected for imperfections and leaks by the testing device shown in Fig. 1. The equipment is mounted on a table, the right-hand side of which is provided with a cut-out portion to receive the work section. A brass seat-plate, clamped over the ends of the superheater, has an inlet and an outlet connection that allows water to pass through both it and the work. The outlet connection is provided with a valve to either withhold or permit the escape of water used in testing the work.

The layout of the testing mechanism is illustrated in Fig. 2. Water is passed through the pipes until the work is filled. It enters at the left and fills the hand-pump line in addition to passing directly to the work. At this point, operation of the hand pump builds up the pressure to 350 or 400 lb., the pressure being indicated on the gage *A*. After examination of the work, the water is turned off by the valve *B* and compressed air is turned on by the valve *C*, forcing the water out

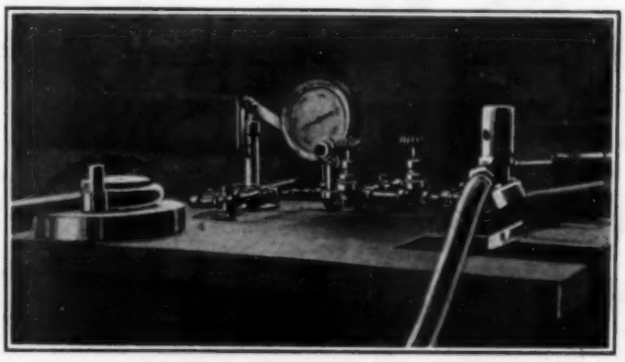


Fig. 1—Testing equipment for superheater sections

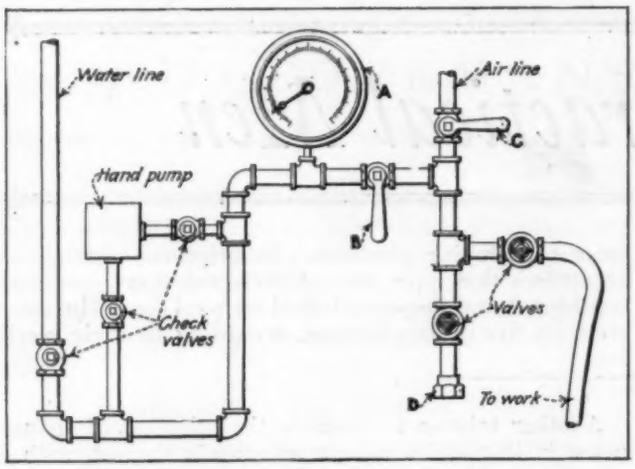


Fig. 2—Details of piping arrangement

of the work, providing of course that the outlet connection on the brass seat-plate is set accordingly. The connection shown at *D* is used for testing other work.

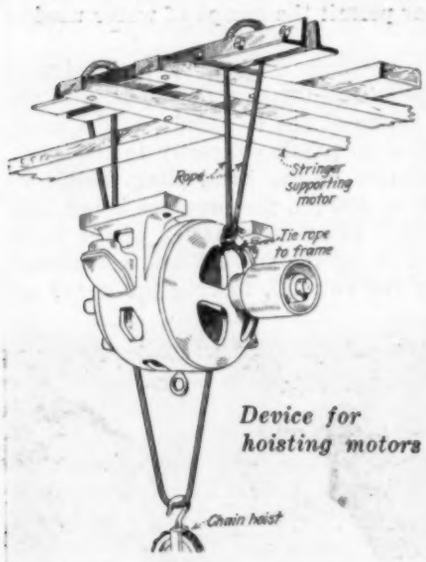
Referring to Fig. 1, a bending attachment for unit ends is shown mounted on the left-hand portion of the table. In use, the work is heated, then placed between the center forming plug and a pin inserted in the rear portion of the base and drawn around the plug by hand, until the pin shown in the front portion of the base can be inserted. The work then is bent in the opposite direction to complete its form.

Lifting Motors for Overhead Mounting

By Fred Fisher

The illustration shows a convenient arrangement for lifting motors and holding them in position while they are being fastened to overhead stringers. It consists of two pieces of 2x2x¼-in. angle iron, two 3-in. grooved pulleys, a rope and a chain hoist.

The pulleys are mounted between the angle irons, bolts being used for them to run on. Several bolt holes can be drilled in the angle irons so the spacing of the pulleys can be arranged to suit motors of different sizes. The angle irons are placed on top of the stringers to which the motor is to be fastened, and the ends of the rope are passed over the pulleys and attached to the motor frame, as shown. A chain hoist attached either to the floor or to a nearby machine, is hooked into the bight of the rope.



Device for hoisting motors

Operating the chain hoist will raise the motor only part of the necessary height at one time, so that the motor must be blocked while a shorter hold is taken.

Acquiring the Knack of Freehand Lettering—Discussion

By R. B. Smith

In an article under the title given above, and published on page 294, Vol. 65, of the *American Machinist*, Frank W. Bentley emphasizes the need of practice when learning to letter. While Mr. Bentley is absolutely correct, he has overlooked the two points that he undoubtedly followed, though he followed them subconsciously. These points if actively brought to the attention of the student will assist in reducing the time required for practice and in the development of uniform lettering. First of all, the student must see clearly in his mind's eye a picture of the letter he is to form, so that he is virtually tracing this image on his paper. Second, the student must have a perfect co-ordination between his mind and the muscles of his fingers.

The following method has been used by me both in classroom instruction in lettering and in the drafting room, and has proved highly successful in both cases. Taking each step by itself, it is first necessary for the student to know what he wants his hand to do. For this purpose a single letter should be carefully studied so that the contour of that letter is firmly fixed in the mind, and a perfect mental picture of the letter retained. The letter itself should then be covered up and an attempt made to reproduce it in both size and shape. After the completion of a single letter, the original should be uncovered and a careful comparison and analysis of the reproduction be made. With a little practice, the student will soon learn to criticize his own work so that he will be capable of picking out the most minute variation between the reproduction and the sample. Having criticized the first letter formed, the student should again study the outline of the same letter, cover up the copy and attempt a second reproduction. A repetition of study, reproduction and criticism, when faithfully carried out, will soon develop the ability on the part of the student to recognize the various curves used, and to retain in his mind's eye the combination of curves and straight lines involved.

The co-ordination of the hand and the eye is sometimes more difficult, since it is not easy for a man whose hands are more or less stiffened by hard work to develop the flexibility of finger and wrist necessary to good lettering. At the same time, it is possible for anyone to obtain a certain degree of skill in this respect if he will consciously keep his mind on the muscles involved. Having before him a clear conception of the letter to be formed, the student must consciously drive the point of the pencil as he wants it to go.

In practicing lower-case letters, commonly known as small letters, it is not necessary to go through the entire alphabet letter by letter. An inspection of any standard alphabet will show that there are a few basic letters which are involved in the remainder of the alphabet. For instance, the letter *a* requires practically the same movements as the letters *d*, *g*, and *q*, therefore, the student should first concentrate on the letter *a*. The letter *b* is reproduced in the letter *p*. The letter *c* is the basis for the letter *e*, and so on. The student will automatically pick out these key letters as soon as he learns to analyze contours, and by concentrating his practice on them, taking one at a time, he will soon complete the entire alphabet, otherwise the relationship between the letters would be lost sight of.

Characteristics of Nickel and Nickel-Chromium Cast Iron

The beneficial effects of nickel on cast iron have been known since 1889, but the use of nickel cast iron and nickel-chromium cast iron has extended only recently. Nickel in amounts from 1 to 5 per cent, usually under 3 per cent, is now being added to cast iron for the making of many parts.

Both nickel and chromium have been found to strengthen cast iron. Nickel increases the strength and elasticity of the iron. It also refines the grain and reduces porosity. Nickel improves the machining qualities of cast iron by eliminating hard spots and chills. Cast iron with from 4 to 5 per cent of nickel gives a fine finish when machined.

Chromium refines the grain of cast iron, but it increases its chilling power and also the combined carbon. If chromium is used alone or in excessive amounts it produces hard spots in the iron. But nickel restrains the chilling action of chromium, and by the use of proper combinations of the two metals the beneficial effects of chromium can be obtained without its disadvantages. The usual combinations are two or three parts of nickel to one of chromium.

Cast iron alloyed with nickel and nickel-chromium can be produced in any foundry. The nickel and chromium may be added to the iron in the cupola or in the ladle. For cupola additions pig nickel or nickel-chromium alloys are used, while for ladle additions nickel or alloy "shot" are employed. Ferro-nickel alloys and prepared "shot" can be obtained commercially for foundry use.

When nickel is added to iron less silicon is needed to keep the castings gray and machinable. The use of silicon in cast iron to reduce the chilling power and eliminate hard spots impairs the physical properties of the iron, making a more open grain and decreasing the hardness and strength. Nickel, on the other hand, improves these properties.

The machinability of gray iron depends on its freedom from chilled areas and from carbide spots which dull the tool. The amount of nickel added to the iron to eliminate these unfavorable properties varies from ½ to 4 per cent, depending upon the silicon content and the section thickness of the castings. In the accompanying table are given the amounts of nickel and chromium recommended to secure hardness and strength with maximum machining qualities in iron castings of different sections containing from 3.30 to 3.50 per cent of carbon.

Nickel cast iron is recommended for castings such as heavy couplings that are machined all over and are required to be strong and free from porosity. In castings of this class, with 1½ to 2½ per cent of nickel, it is possible to lower the silicon content 50 points below normal and secure a dense strong casting. In automobile cylinders cast upright it was found that ordinary cupola iron showed a decreasing hardness of wall from base to dome of from 160 to 190 Brinell due to the gradual change in the rate of cooling. By adding 1.50 per cent of nickel and 0.50 per cent of chromium the hardness was increased to 225 with uniformity throughout the cylinder casting. The nickel-chromium cast iron cylinders with increased hardness machined as freely as the plain iron.

In normal cupola practice, where the silicon content of the iron varies from 0.25 to 0.50 per cent, the addition of nickel will insure tough, uniform gray castings that will result in fewer rejections in the machine shop and give better wearing qualities in service. Uses advocated for nickel and nickel-chromium cast iron are for the casting of cylinders, cams, gears, hardware, bushings, machine frame castings, liners, and plates. Nickel also raises the electrical resistance of iron, and nickel cast iron containing 4 to 5 per cent of nickel has been used for resistance grids for a number of years.

Per Cent of Nickel and Chromium for Cast Iron

Silicon	Light Sections ¼-In. to ½-In. thick		Heavy Sections 1-In. to 3-In. thick	
	Nickel	Chromium	Nickel	Chromium
1.00-1.50	1.50-3.00		0.75-3.00	0.20-0.60
1.50-2.00	0.50-2.00	0.00-.30	0.75-3.00	0.40-1.00
2.00-2.50	0.50-1.50	0.00-.40	0.75-3.00	0.50-1.10
2.50-3.00	0.50-1.25	0.20-.50	0.75-3.00	0.60-1.25

Nickel is not oxidized or burned out of cupola-melted iron as are such elements as silicon and manganese. The nickel can be charged directly into the cupola, care being taken to separate the charges containing it and to tap off each separately. Pigs of commercial 99 per cent nickel are placed near the center of the charge between the pig and the scrap.

A special form and composition of nickel called "F-shot" has been developed for ladle additions to the iron. This shot melts at 2,300 deg. F., whereas the melting point of nickel is 2,650 deg. F. The iron in the ladle should be at a temperature of not less than 2,400 deg. F. when the nickel is added. The F-shot contains approximately 92 per cent of nickel, and calculations are made on that basis. The shot is added while the iron is being poured into the ladle. After the bottom of the ladle is covered with about 2 in. of iron the nickel shot is sifted in with the molten iron and aimed to strike the surface in front of the stream of iron. It is instantly dissolved.

Chromium oxidizes in the cupola, and for that reason it is usual to expect only a recovery of from 75 to 90 per cent. Alloying iron with nickel and chromium may be accomplished in the cupola by the use of a ferro-chromium or nickel-chromium alloy, or it may be done in the ladle by the use of F-shot and ground ferro-chromium or by the use of ground nickel-chromium alloy. When alloys are made in the ladle the iron will be cooled proportionately to the amount of alloy added, and a temperature allowance should be made accordingly.

For the information given we are indebted to the International Nickel Co.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Handling the Lubrication Problem

Q. The use of oils in our plant has grown considerably in the past two years, and we are under the impression that we are not getting the greatest economy from the quantity of oil consumed. It is our idea to start an oil house apart from the present shop departments. What is the proper start to make towards this end?

A. The actual physical layout of the oil house will depend upon the quantity of oils handled. For the average or small shop a fireproof shed with concrete floor will do, and the oil can be kept in the original drums or barrels and drawn out by means of individual barrel pumps. For quantity handling of oils the accepted standard designs of any of the oil companies should be used.

The organization of the oil distribution is of greatest importance. A detailed investigation would undoubtedly reveal that under present conditions your shop is not only using more oil than necessary, but is not using the various kinds of oil in the most effective or economical manner. The man placed in charge of the oil house should be a mechanic capable of ascertaining the proper oil for each shop use. He should issue the oils on requisitions for specific uses. He should submit regular reports on the oils used by each department and for each requirement.

The preparation and issue of cutting compounds should also come under the supervision of the oil house. When these are regulated under one man it will be found that more satisfactory service will be attained. If you select the right type of man to take charge of your lubrication problems and handle the oil house, we believe that better results and considerable economy will be obtained from the start.

Checking Up the Heating System

Q. The article on modernizing old heating systems on page 649, Vol. 16, of the American Machinist *was very interesting to us, and we would like to check up on our own heating plant. Can you tell us how to do this without calling in a heating engineer?*

A. You should first check up on your radiators or heating pipes to determine if they have sufficient radiating surface to maintain a proper temperature in the rooms. Then the total radiating surface of the entire plant should be checked against the heating capacity of the boiler to see if the latter is of adequate size.

The radiating surface requirements will vary with the amount of outside wall and the number of windows, but a general rule for factory buildings and storehouses is to allow one square foot of radiating surface for 75 to 100 cu.ft. of space to be heated. The size of boiler required may be roughly estimated by allowing one square foot of grate surface for every 400 sq.ft. of radiating surface in the plant.

These calculations will, of course, give you only a rough check on your heating installation. The advice of a heating and ventilating engineer would be most valuable on the proper location and distribution of your radiators and returns. One of the bad features of old heating systems is that radiators or pipes were often placed under benches or in isolated corners with the idea of getting them out of the way rather than of obtaining most effective heating location.

Warping of Welded Plates

Q. We find that in welding ½-in. steel tank plates, the plate has a tendency to warp and to bow in the direction of the weld. How can we avoid this? We do not want to anneal the plates.

A. The bowing of the plate is due to the contraction of the deposited metal. This effect is apparent when a progressive weld is made from one side to the other. You can minimize the effect of contraction by first welding spots at various points along the seam, and then welding the short intermediate sections one at a time.

Warping in the opposite direction is probably due to the use of a large bevel at the joint. The contraction of the large amount of deposited metal at the top of the V will naturally draw the plate upward or bow it about the V. This can be minimized by decreasing the slope of the bevel.

Size of Loose Pulleys—Discussion

BY U. SETH EBERHARDT

On page 378, Vol. 65, of the *American Machinist* you describe Mr. Barth's practice of making the loose pulley 1 in. smaller than the tight pulley, and of making a steep bevel on one side to assist in shifting the belt.

I have seen loose pulleys made in this manner, but have never seen one work satisfactorily. As a matter of fact, I have seen belts creep up the bevel and hop over to the tight pulley and thus start up the machine. Also, when an automatic tripping device is used to shift the belt, the movement is often obstructed when the steep bevel is employed on the loose pulley because the belt delays or hangs behind. The steep flange, moreover, has a bad effect of stretching the belt continuously on one side.

Our practice on pulleys 18 in. in diameter is to make the loose pulley about ¼ in. smaller in diameter than the tight pulley. This gives approximately ⅜ in. in the length of belt for relieving the tension when not under load. We do not put the steep bevel on the loose pulley. We believe that the short steep flange is used by few manufacturers, and then only because they have not followed up its harmful results.

Technical Abstracts

Britain Studies America

Commenting on the book "The Secret of High Wages," by Austin and Lloyd, John Calder points out that the conclusions of the British authors were drawn from a study of the vertical trust type of American "big business." Had they studied smaller concerns as well they might have discovered a certain lack of the efficiency they praise. Their analysis of the trouble with British industry shows these faults: The mistaken belief that executive ability is always inherited; the dullness and inefficiency of some of the older directors on British boards; the laxity of management in many small concerns that make a living for the proprietor without great effort on his part; and reluctance to depart from established manufacturing traditions. Mr. Calder checked the findings of Austin and Lloyd with a member of the *Daily Mail* deputation of union machinists that visited the United States. This man agreed that the findings were correct but regretted that the present fortunate status of American workers was not, in many cases, the result of the use of the machinery of traditional trade unionism. It was pointed out to him that the American worker has usually no social theory which makes him unhappy and does not intend to remain forever in the industrial trenches. Hence, he is not much occupied in seeing how little prosperity he can help to bring to his employer's business.—*The Management Review*, October, 1926, p. 295.

Group Drive and Individual Motorized Drive

Group driving will not be entirely displaced by individual motorizing unless some unexpected developments occur in the motor field. There are advantages to both systems of drive, depending upon the particular industry. The textile industry, for example, is especially suited for group drive. In the machine tool field, on the other hand, the tendency is toward individual motor drive. In general, the latter form seems to predominate in new installations.

If first cost is of importance, group drive is the cheaper solution. However, safety laws are often a factor, also lighting, building construction and floor space, in the selection of individual drives. Another advantage of individual drive is the fact that a series of machines can be placed as best suits the convenience of the production routine, and not necessarily in conformance with a given arrangement of line shafting, with which they would otherwise have to be aligned.

With group drive, a smaller number of motors involves fewer complications in wiring and controls. In addition, the power factor can be improved through the use of synchronous motors, made only in large sizes, while individual motors are invariably the induction type, involving low power factors.—F. H. Penny in *Mechanical Engineering*, September, 1926, p. 889.

The Mechanism of Fatigue

An investigation is being carried on at the Institute of Metals at Liége to discover the causes of fractures in metals under repeated stresses of low magnitude. Preliminary study revealed that strain hysteresis and slip bands were produced within practically all ranges of stress, but that the resistance to slip increased up to the point of fracture. Later tests made on single crystals of aluminum showed that, whether the stress were direct, torsional, or single-blow tensile, a series of slip bands was produced that indicated a structure composed of planes. By means of X-rays these planes were found to correspond to the octahedral planes normally formed by atoms of aluminum. Even under the smallest loading, some degree of permanent set occurred, and no complete primative elasticity could be determined. Eventually slippage stops, but the shear stress on the planes continues to build up until the first crack starts. The planes appear to become distorted, thus producing intense local stress until inter-atomic breakdown occurs. Outwardly this stress appears in the form of increased hardness.

The experiments have not yet been concluded, but the fact that all types of strain act similarly introduces a valuable simplification in the conception of the mechanism of fatigue.—Editorial in *Engineering*, Oct. 1, 1926, p. 422.

Oxygen Purity and Temperature in Metal Cutting

A series of tests extending over a period of eight months was made by the General Electric Co. to determine the relative efficiency of 99.5 per cent oxygen as compared with 98.5 per cent oxygen in metal cutting, and also to see what advantages would be gained by heating the oxygen.

The cost of producing oxygen of 1 per cent greater purity averages about 15 per cent. The trade has been educated to use the 99.5 per cent oxygen but it was found that the economies are much lower than usually stated, and that the temperature of the cutting oxygen is worthy of greater consideration.

Nitrogen molecules interfere with the concentration of oxygen, and it was found that by the addition of heat to the cutting oxygen these nitrogen molecules are more easily blown out of the way, thus increasing the speed of cutting. A temperature of 200 deg. C is obtained at slight cost, but it produces an economy in the cutting oxygen as high as 35 per cent.

Moisture in the cutting oxygen results in rough cuts and retardation due to the cooling effect. By heating the oxygen to 200 deg. C., the moisture is changed to steam and the cooling effect greatly reduced. A quicker start is also possible with a heated cutting jet, and this point is important in applications such as rivet cutting where many starts must be made.—F. P. Wilson, Jr., in *General Electric Review*, October, 1926, p. 722.

Correcting Loose Pulley Troubles

In a large factory where I was in charge of power transmission there were 3,000 pieces of major equipment. Here five men were employed in repairing bushings on loose pulleys and renewing work shafting. For the most troublesome conditions, ball bearing loose pulleys were prescribed as replacements. After 200 of these had been installed only one man was needed for this repair work. Figuring reduced maintenance and fewer interruptions in service these pulleys paid for themselves in less than a year.

Another commendable feature to embody in loose pulley design is a loose pulley of considerably smaller diameter with a steep tapered flange. This relieves the tension of the belt when idling, and the flange enables the belt to be shifted to the tight pulley with ease. It also prevents the belt from creeping off of the loose pulley and starting the machine unexpectedly. Where a countershaft is hung overhead, as is usually the case, the belt is shifted from one pulley to the other by means of rigid forks mounted on a horizontal rod operated by a wooden handle within reach of the operator.—L. H. Hopkins, in *Industrial Management*, October, 1926, p. 211.

Chatter Marks on Ground Work

Chatter marks are a detriment to efficient grinding. In connection with cylindrical grinding, chattering can be laid to a number of causes, such as the grinding machine centers not fitting those of the work, loose wheel spindles loose wheel slides, head or tailstock loose on the platen, incorrect relation between the wheel and the work speed, lack of steady rests, wheel not trued correctly, wheel out of balance, and end play of the work between centers. —*Abrasive Industry* for November, page 343.

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Established 1877

Advertising's Place Is Secure

NOT many months ago the conservative ecclesiastic at the head of the English Church testified to the value of advertising as a force for good in the community. Last week the President of the United States attributed to advertising a large share of the responsibility for the unequalled prosperity of the country. There is even talk that a national advertising campaign to stimulate religious thinking will be put on next year. Obviously, the power of advertising is recognized by world leaders.

Contrast these opinions of advertising with the lack of faith in its potentialities that was almost universal a generation ago. Many good people looked with suspicion on all advertising then, and there was reason for the attitude because advertising perforce reflected the business ethics of the day. It would probably be wrong to give advertising all the credit for bringing business ethics up to their present high standard, but certainly the advertising men were among the first to discover that their efforts were of no avail if the product and the practices of a client were not honest.

The place of advertising in the modern economic structure is secure. As President Coolidge says: "It is on the foundation of enlarging production through the demands created by advertising that very much of the success of the American industrial system rests." Those who still doubt would do well to accept Mr. Coolidge's assertion and shape their plans accordingly.

Broader Education for Engineers

IT SEEMS to be common experience in all branches of engineering that the man with the broadest education rises to the top in the end. His early progress, it is true, is usually less rapid than that of the man who has been given more technical training before leaving college, but if his grounding in fundamentals has been thorough he will bring a more liberal viewpoint to bear on the problems that face him and his solutions will generally be better, particularly after he has gained practical experience.

The appeal for funds for an engineering laboratory, and its equipment, to care for the engineering school at Princeton University has attracted attention to the Princeton plan of liberalizing engineering education. At Princeton, of course, with its cultural traditions, the introduction of liberal studies in the engineering curricula is both logical and easy. On the advice of prominent engineering alumni some of the more strictly technical courses have been replaced by English, economics, logic, public speaking and free electives. The resultant curriculum fulfills, in most respects, the requirements set up by the Wickenden investigation. Further broadening of the students' minds is secured by assigning them to groups of academic students wherever possible so that they get the point of view of boys whose interests are far from engineering.

Of all the attempts to broaden engineering education that at Princeton is one of the most promising. It is favored by the nature of instruction given, by the active interest of the alumni, and by the type of boy that Princton can draw. The physical equipment is secondary to all of these but it is badly needed nevertheless.

Labor Unionism and the Church

JUST why a union labor leader should be invited or permitted to speak from a church pulpit on Sunday is hard to see. A propagandist by reason of his calling, there can be no doubt as to the nature of his remarks. If a great moral issue were at stake it might be desirable to hear the advocates of both sides but one can hardly connect the modern type of labor unionism with moral issues. It is primarily concerned with economic problems and so has no place in a body of people met together for religious observance.

In the recent Detroit case it is particularly unfortunate that the matter was handled as it was because, as one commentator puts it, "what might have been a mild dose of unpleasant propaganda has been transformed into a country-wide outcry against narrowness and abuse of power and the campaign for unionized labor in the automobile shops is launched under the favoring impetus of oppression." The attempt to break away from a bad precedent may have serious results.

Are Lower Prices Coming?

THERE has been a decrease in prices during the last year, without diminution in industrial profits. This condition must indicate a proportionate elimination of waste.

Further reduction in prices will have to be achieved by the same means, or by a reduction in wages. Resistance against lower wages is stronger than it ever has been, and comes from the employer as well as the employee.

It seems, therefore, that further declines in prices are not imminent, except as they can be brought about by further elimination of waste and by developments resulting from research.

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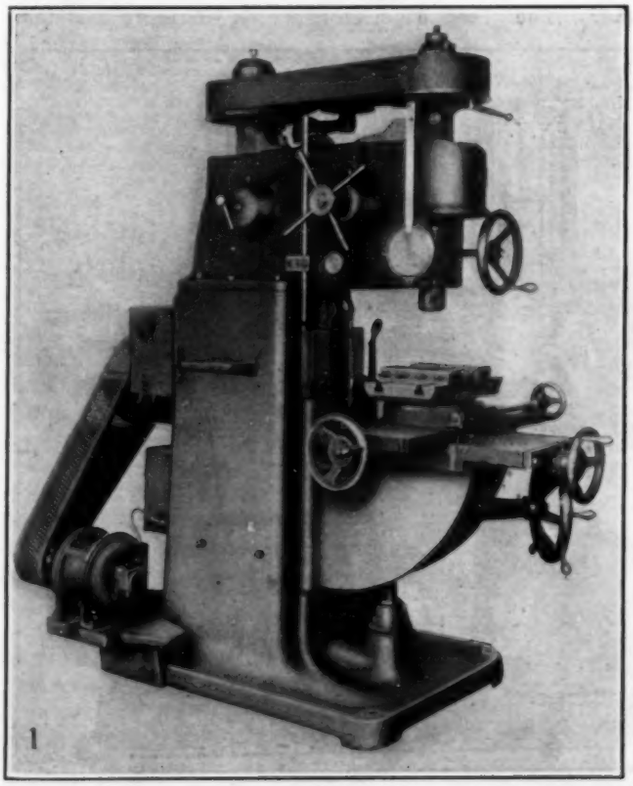
Pratt & Whitney No. 3-A Universal Die Sinker

The Pratt & Whitney Co., Division Niles - Bement - Pond Co., Hartford, Conn., has developed the No. 3-A universal die sinker shown in the accompanying illustrations. It has been designed to handle both cherrying and straight die-sinking operations without any changes of set-up or without special attachments. The design is such that it is possible to perform both roughing and finishing cherrying operations with a single cutter for a wide range of diameters. When performing these operations the cutter spindle rotates through a circular path, but for ordinary die-sinking work the entire head is locked in place.

The machine is similar to the regular Pratt & Whitney die sinkers in that it is of the vertical type and has a knee supported by an elevating screw and sliding on vertical ways on the front of the column. This knee carries a table, which can be traversed in both directions as in the regular die sinker. In this machine the column is made of two pieces and the knee is counterweighted to permit easy adjustment. The special features of the No. 3-A die sinker are the oscillating head, the control apparatus, and the drive connected with it.

The upper part of the column carries the oscillating frame and spindle mechanism on its two inside surfaces which have a scraped-in fit. The oscillating frame itself is balanced by a counterweight and is driven by two large adjustable-throw eccentrics. It is by means of these eccentrics that the circular motion of the entire frame and hence of the tool is obtained.

The diameter of the circular path of the tool can be adjusted from 0 to 6 in. by means of a mechanism inside of each eccentric, that is controlled by an adjusting handwheel. A dial on the side of the column connected to the eccentric indicates the diameter for which the machine is set. It also indicates the exact position of the cutter in the work during a cherrying operation. This indicator dial is graduated through 180 deg. and is inscribed with six circles which represent the six even-inches of radius adjustment of the eccentric sleeves. It is held in position by spring tension and may be revolved and set by means of two finger spot holes. A long finger or pointer is attached to the oscillating frame, while the dial itself is stationary. This finger is graduated horizontally to give subdivisions of the six even-inch circles on the dial, and in this way the relative position of the pointer on the dial always represents the actual position of the tool point in the work. The oscillating frame is moved entirely by hand by means of a handwheel at the front of the head. For ordinary die-sinking cuts wherein the table elevat-



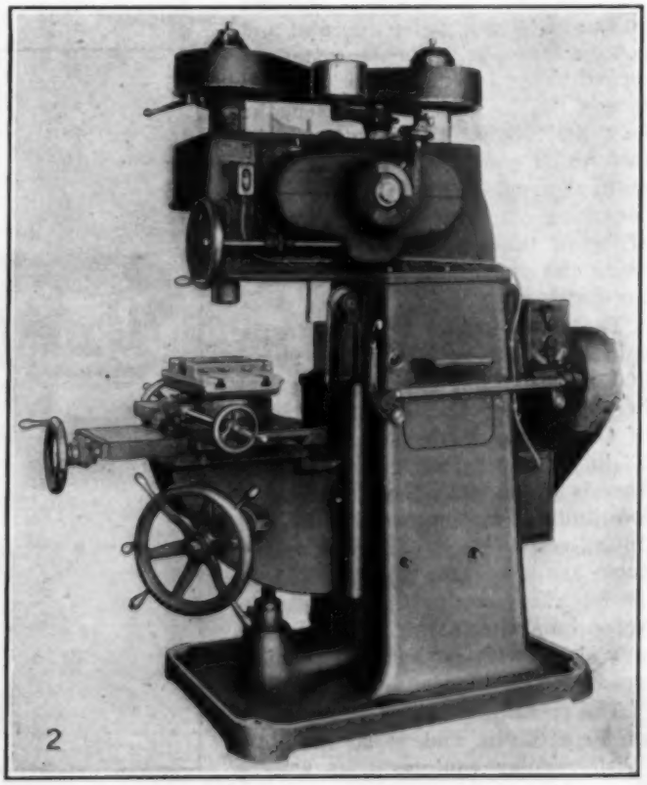


Fig. 1—Pratt & Whitney No. 3-A Universal Die Sinker. Fig. 2—Rear view of the machine

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ing and traverse controls are employed, the entire oscillating head can be solidly clamped to the column by means of a double binder.

The spindle is hardened and ground at the lower end and is fitted with lapped thrust washers. The lower bearing is conical, while the upper one is cylindrical. Adjustments for wear are made on the lower bearing. The spindle is fitted with a spring collet operated by a quick opening and closing device.

The drive to the head is by means of a single pulley and a gear box that drives the pulleys on top of the oscillating head through a set of floating bevel gears. A 3-hp. constant-speed motor furnishes the driving power.

Besides straight die sinking, rough and finish cherrying operations, the machine is capable of performing special combination jobs. For instance, by combining rotary table feed with oscillating cutter movement, it is possible to sink a hemispherical cut in the surface of a die and to finish it, up to the polishing operation, with the same cutter and without the use of any attachments. A quarter cylindrical cut can be taken by feeding the cutter through an arc of 90 deg. using the dial and pointer for positioning the cutter. A second cherrying cut below the surface of the die can also be taken, the only limit being the length of the tool which can be used successfully without springing. An inverted cherrying cut can be taken either at or below the surface of the die by using the upper half of the oscillating head.

The machine is provided with six spindle speeds ranging from 90 to 900 r.p.m. The maximum vertical height between the working surface of the table and the spindle end is 23 in. The vertical traverse of the knee is 18 in., while the traverse and longitudinal movements are 12 and 18 in., respectively. The vise on the table has a working surface of 11 x 18 in. The longitudinal and transverse handwheels for the table are provided with micrometer dials graduated in thousandths of inches.

The machine occupies a floor space of 70 x 95 in. and is 93 in. high. With regular equipment, it weighs approximately 7,000 lb.

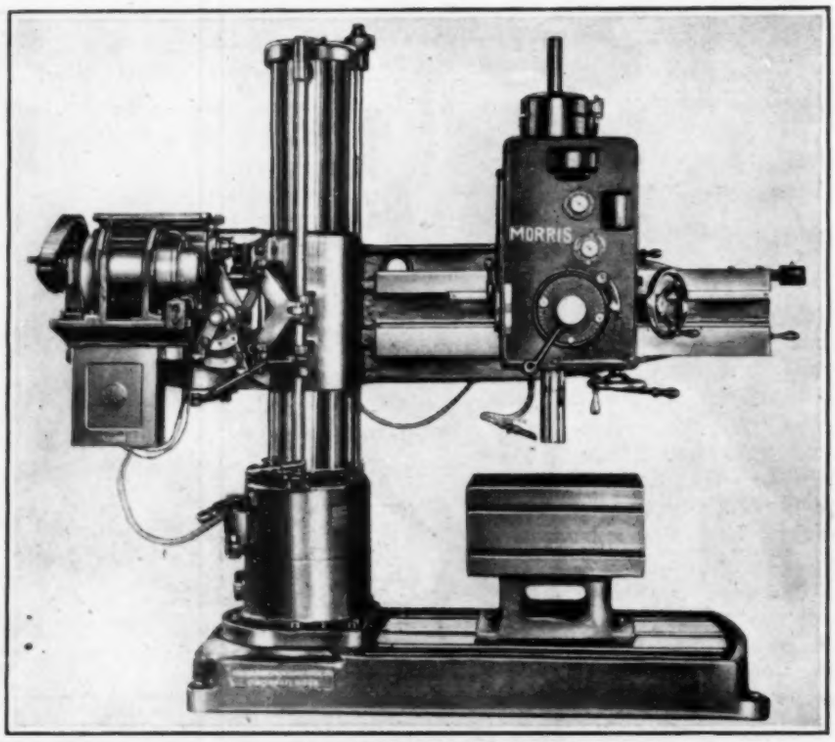
Morris Heavy-Duty Radial Drills 3,-3½,-and 4-Foot

The Morris Machine Tool Co., Cincinnati, Ohio, is marketing a line of heavy-duty radial drills in 3, 3½ and 4 ft. sizes. The 4-ft. drill is illustrated. In each case the motor is mounted upon the arm. This construction is said to have several advantages: the arm is balanced, the motor is up out of the way from dirt and grit on the floor and considerable mechanism necessary to transmit the power from a remote motor to the arm and raising mechanism is eliminated. Either a direct-current variable-speed motor or a constant-speed alternating-current motor employing a ball-bearing speed box can be used.

The head is fully inclosed and is said to be well balanced on the arm so that it travels freely. An adjustable taper gib is provided to take up wear. One lever operates two clamp screws securely holding the head on the arm without affecting the alignment. At the top of the head is an oil reservoir from which the lubricant is distributed to the bearings throughout the head. The feed worm wheels, however, dip in a separate trough of oil.

The spindle is a hammered steel forging, driven by means of two keys, and is mounted in phosphor bronze bearings in the sleeve. The sleeve, having the rack cut directly in it, is also made of steel and is fitted with bronze bearings. Thrust from the spindle is taken on a ball thrust bearing. Ball bearings are also used to carry the helical gear driving the spindle. The driving gears are made of a special alloy steel, heat-treated, and are of small diameter so as to keep the peripheral speed down to a minimum, in order to reduce the possibility of trouble when reversing on high speeds.

The feed gears are also made of heat-treated steel, and the entire feed unit is mounted in the head. There are six feeds on the 3- and 3½-ft. machines ranging from 0.005 to 0.030 in. per revolution of spindle. On the 4-ft. drill, there are eight feeds ranging from 0.005 to 0.042 in. per revolution of the spindle. In addition, on this size, there are four tap-



Morris Heavy-Duty Radial Drill, 4-Ft.

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thread leads: 8, 11½, 14, and 18 threads per inch.

The tapping attachment and back-gear bracket is a unit mounted on the back of the head. The clutches in the tapping unit are of the multiple-disk type, and the entire unit runs in oil. The back gears and back-gear clutches are made of chrome-nickel steel, heat-treated.

The speed box is of the sliding-gear type mounted upon ball bearings. The gears are made of heat-treated alloy steel and run in oil, which also lubricates the ball bearings by the splash system. By means of a speed lever and speed chart the operator can quickly select any one of the spindle speeds.

The column is made of semi-steel and is ground to size. It revolves upon ball bearings and is mounted on an inner column, which extends through to the top of the machine.

The arm has been designed to resist torsional and lifting strains. Bearing on column is long, and the arm can be clamped in any position by means of a single lever convenient to the operator. Power raising or lowering of the arm is controlled through a lever near the bottom of the column.

This lever has two functions: First, it automatically unclamps the arm before the elevating or lowering gears are engaged. A further movement engages the gears and the arm is raised or lowered to its desired position. When the lever is brought back to its central position, where a latch catches and holds it, the gears are disengaged and at the same time the arm is clamped. With this design it is claimed that it is impossible to engage the gears while the arm is clamped. At the same time the operation of clamping and raising or lowering the arm is made a very rapid one.

The base is heavy and well ribbed, and is provided with T-slots. The oil channel around it drains through a screen into a large reservoir, which has an overflow partition to keep chips and dirt out of the pump. The pump is furnished extra. A box table is furnished as standard equipment. A worm tilting table can also be furnished at extra cost.

SPECIFICATIONS

Drill Size	3 ft.	3½ ft.	4 ft.
Maximum distance between spindle and base, in.	52½	52½	60
Minimum distance between spindle and base, in.	15	15	7
Maximum distance between spindle and table, in.	31½	31½	39
Spindle traverse, in.	12½	12½	17
Head traverse on arm, in.	28½	34½	38½
Number of spindle speeds	18	18	27
Spindle speeds, range, r.p.m.	36 to 700	36 to 700	24 to 612
Working surface of base, in.	30 x 41	30 x 47	36 x 51
Working surface on table, in.	18 x 18	18 x 24	18 x 24
Total height, spindle in highest position	96½	96½	123½
Motor recommended, hp.	5	5	7½
Motor speed, r.p.m.	1200	1200	1200

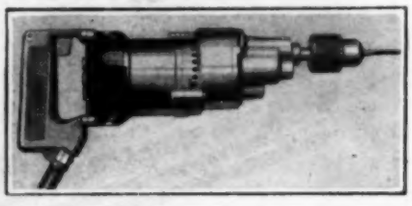
Van Dorn No. 2 Electric Tapper, Portable

The No. 2 portable electric tapper shown in the accompanying illustration is being marketed by the Van Dorn Electric Tool Co., Cleveland, Ohio. It is for use on jobs that can be handled faster and more economically by taking the tapper to the work. It is particularly suited for fitting splash pans on machine tools, for putting dust covers on electric motors, and for similar classes of work.

The tapper is equipped with the same heavy-duty motor as used on the ⅛-in. portable drills made by this company. The motor is universal and will run on both alternating and direct current. Sufficient power is provided to tap a ½-in. hole in cast iron, a ½-in. hole in steel or a ½-in. hole in aluminum and brass. Forward no-load speed is 340 r.p.m., while under rated load the forward speed is 200 r.p.m. Special no-load speeds of 275 and 485 r.p.m. and up, can be furnished extra.

Only a slight pressure on the spindle is necessary to drive the machine forward. It automatically reverses at double speed when a slight backward pull is placed upon the handle after the hole is tapped. Regular equipment includes a grip handle, automatic safety switch, a ½-in. three-jaw geared chuck and 10 ft. of cable with plug. The design of the cable attachment to the tool is such that it can be quickly detached. The gears used in the tapper are made of heat-treated steel.

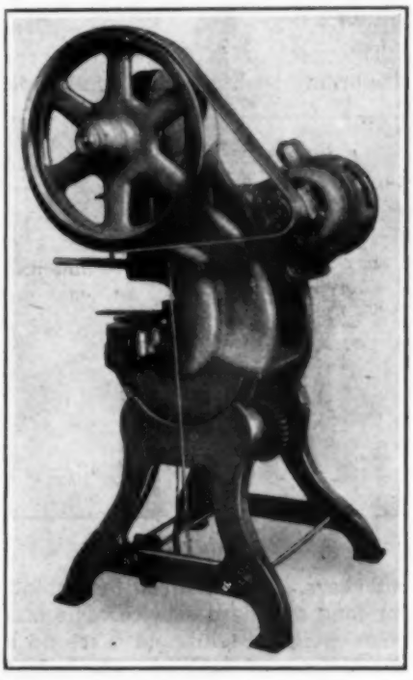
The unit weighs 8 lb., while its overall length is 14½ inches.



Van Dorn No. 2 Electric Tapper, Portable

Motor Bracket on "Standard" Presses

The Standard Machinery Co., Auburn, Rhode Island, has applied to some of its presses a trunnion-mounted motor bracket that allows a portion of the weight of the driving motor to be applied against the pull of the belt, so that the belt is always under uniform tension, regardless of its natural stretch.



Motor Bracket on "Standard" Presses

The use of this bracket obviates the necessity of repeatedly shortening the belt or of using an idler. A belt may run for its full life without being taken up; the shifting of the bracket by gravity automatically compensates for the stretch of the belt. In addition, the motor bearings are insured against undue overload.

Provision is made to keep the mo-

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tor bracket from turning completely over in case of belt breakage.

The same bracket may be attached rigidly to the top of press frames in case a direct gear and pinion drive is desired.

Alto Reaming Machine

The bench reaming machine shown in the accompanying illustration is being marketed by the Alto Manufacturing Co., 1647 Wolfram St., Chicago, Ill. The machine is intended to take care of simple production reaming that is usually done by hand.

The machine has two reamer speeds, 30 and 60 r.p.m., and is driven by a ¼-hp. motor. The geared scroll chuck provided with the machine will take reamer shanks ranging in size from ⅛ in. to 1½ in. in diameter.

The machine is fitted with oversize bronze bushings, and extra-wide

Alto Reaming Machine

cut gears. It is claimed to be built for long and hard service. The machine weighs 84 lb., and takes up a bench space of 9x11 in. The height of the machine is 18 in. The standard motor furnished with the machine is for 110-volt, 60-cycle current, but a motor for other cycles, or for d.c. current, can be furnished when specified.

Lewis-Shepard Steel-Frame Platform

The Lewis-Shepard Co., Watertown Station, Boston, Mass., is marketing the steel frame platform for use with lift trucks shown in the accompanying illustration. The truck can be backed in under the platform

Lewis-Shepard Steel-Frame Platform for Lift Trucks

from either side or either end as the clearance on the underside of the platform to the floor is the same on all sides as it is between the legs.

The platform is steel-bound all around so that no end boards are exposed to stand the bumps of the truck as it is backed in under either end. The steel frame is a unit in itself and does not depend upon the clamping of the steel frame and feet to the wood top for its strength or rigidity. Arc welding is used throughout to obtain a single solid metal structure. No bolts or rivets are used in the platform. The top is flat as both the steel frame and the boards are flush with one another.

Bilton No. 10 Pro-Ducto-Matic

The Bilton Machine Tool Co., Bridgeport, Conn., is marketing the No. 10 Pro-Ducto-Matic shown in the accompanying illustration, Fig. 1. The machine is adaptable for slab milling, straddle milling and the milling of squares, hexagons and other flats. It is semi-automatic and runs continuously. The only function of the operator is to unload and reload each fixture as the turret presents it to the unloading station. Several improvements have been made over the older models.

The cutter spindle runs in bronze sleeve bearings and is driven through a worm and wheel unit consisting of a hardened steel worm driving a bronze wormwheel. This mechanism is driven through a universal-jointed telescoping shaft, as shown in Fig. 2. A reduction of 5 to 1 is obtained. By means of a Carlyle-Johnson two-way clutch in the spindle drive, rotation of the cutters can be had in either direction. Ball thrust bearings carry the thrust from the worm. With this unit the arbor can swing cutters 6 in. in diam. in gangs up to 8 in. in width.

The cutter arbor proper is separate from the spindle and has a No. 10 B. & S. taper shank for use with a draw bolt. An outboard bearing supports the arbor beyond the cutters. The entire spindle-carrying

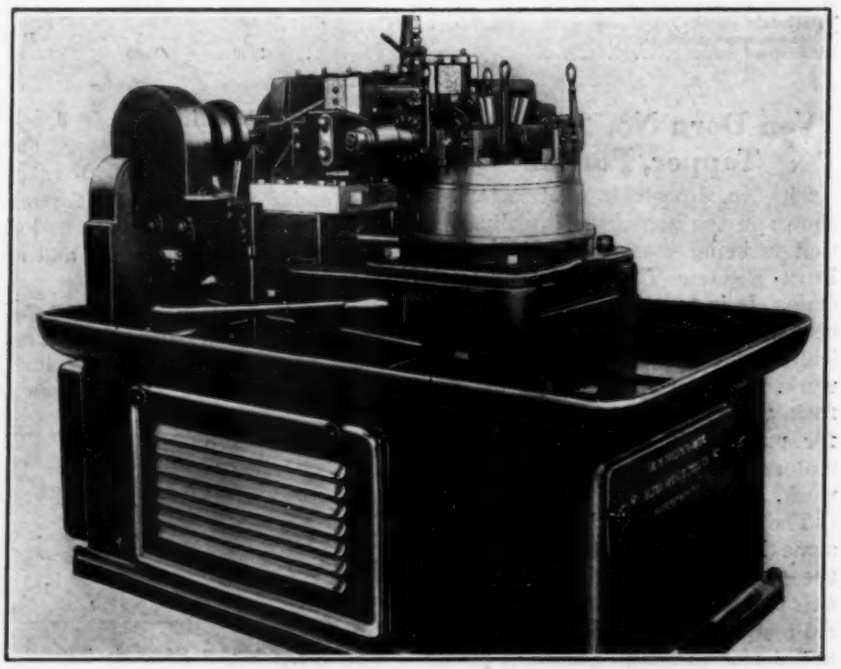

Fig. 1—Bilton No. 10 Pro-Ducto-Matic

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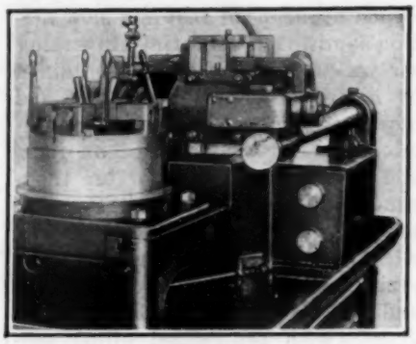

Fig. 2—Rear view showing spindle drive

unit is mounted on a slide that has a positive movement of 5 in. in either direction in a horizontal plane. This movement can be shortened to suit other work by substituting a different control cam.

As in previous models the work is held in special fixtures on a horizontal turret having a vertical axis. The turret may be indexed with four positions, as illustrated, or with six.

The machine has a cabinet base that incloses the driving motor. This motor, rated at 5 hp. at 1,800 r.p.m., drives the gear box on the end of the machine by means of a flexible coupling. All gears in the box are made of heat-treated steel and the shafts are also hardened and ground. They are mounted upon Timken roller bearings and are lubricated through hollow shafts by means of a piston pump that supplies lubricating oil to all the bearings. The gears themselves run in oil supplied from a 40-gal. tank and elevated to the gears by means of chain drive to the various parts.

The cutting compound is also contained in a tank in the base and is delivered to the cutters by means of a No. 3 B. & S. geared pump. Cutter speeds range from 400 to 700 rev. per minute.

The machine occupies a floor space of 48x72 in. and weighs 6,000 pounds.

Cleveland 36-Inch Open-Side Planer Improved

The Cleveland Planer Co., 3148 Superior Ave., Cleveland, Ohio, is marketing an improved planer, 36 in. x 36 in. x 12 ft., shown in Fig. 1, with motorized drive and complete electrical control. By means of drum controllers, power rapid traverse is obtained for both heads, and by the same means, the knee is actuated.

The bed has been made much heavier throughout. It is closed on top and has cross ribs at close intervals to make a box-like construction. Filtered oil is forced under pressure to the Vs, which are broadly spaced to furnish rigidity under the cutting pressure. Automatic rollers and wipers are provided so that the table is wiped at both ends of the stroke. Hence a double-length of bed is not necessary.

The table is also of box section and has T-slots cut from the solid. The rack extends on both ends and is so supported that the full length of the table can be utilized for planing.

The column is cast solid with the bed up to the table level, at which point the upper section is securely bolted and doweled to it. The column

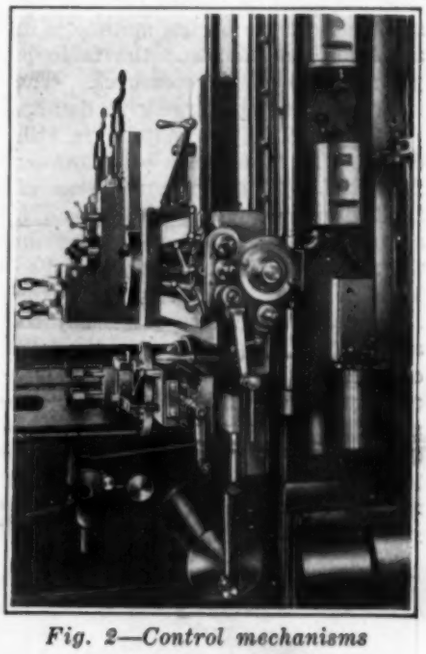

Fig. 2—Control mechanisms

is full-box form without any holes in the sides or top. Combined plate and box-form construction is used for the knee, and its bearing on the column has been increased. It is square gibbed so that the rail, which is bolted and doweled to it can be drawn up parallel to the table. The knee is raised and lowered by means of a power elevating screw equipped with self-aligning ball thrust bearings. Rapid traverse to the knee is controlled by means of a drum controller. Single-turn rail clamps are provided.

The rail is of massive construction and has taper gibs on the slide and improved head clamps. A dial-feed mechanism shown at the end of the rail in Fig. 2 controls the travel of the heads in either direction and at either ends of the stroke. Automatic feeds are also provided for vertical travel. The saddles are graduated for angular planing.

The gearing is of steel throughout

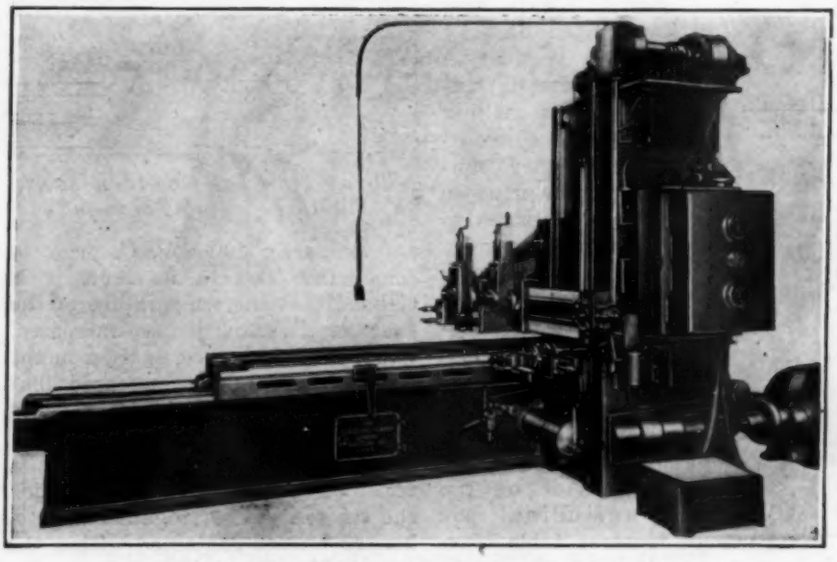

Fig. 1—Cleveland 36-Inch Open-Side Planer, Improved

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and is heat-treated. Pinions and shafts are made of nickle steel, and the latter run in self-oiling bearings. Forced lubrication to the Vs is supplied by a standard Roper pumping unit with a model T "Purolator," which filters the oil after it leaves the pump under pressure.

Pratt & Whitney Jig Borer, Improved

The Pratt & Whitney Co., Division of Niles-Bement-Pond Co., Hartford, Conn., has made several improvements in its jig borer shown in the accompanying illustration, Fig. 1. The fundamental design remains the same in that the boring spindle is in a vertical position and the table is positioned by end measures. The improvements are largely in details.

The drive to the spindle is still obtained by means of a belt running from a large pulley at the rear of the bed up over idler pulleys through a quarter turn to a large pulley on the spindle. The spindle pulley has been widened, however, and the idler pulleys are now made adjustable so that the tension in the belt can be regulated easily and quickly at any time. These idler pulleys are fastened to the rear of the column head by means of bolts passing through slots so that the pulleys may be adjusted up or down as necessary. It is on account of this vertical adjustment that the pulley on the spindle has been widened.

The motor has been re-arranged to make the machine more compact. Instead of being mounted on a bracket at the rear left-hand side of the bed, it is now hung on a swinging platform, as shown in Fig. 2, in approximately the same position but the motor is now mounted on its side. With this arrangement it is possible to adjust the motor belt tension by means of the screw on the motor platform.

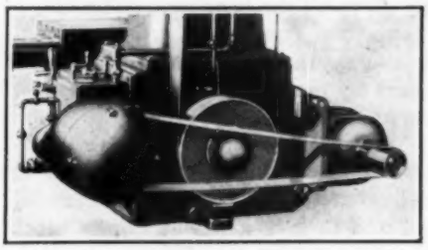


Fig. 2—Improved design of drive

Instead of being through a pair of tight and loose pulleys, the drive from the motor is through a larger size friction clutch pulley totally inclosed in a cast-iron guard, which may be shifted easily from a vertical to the horizontal position, thus making the machine adaptable for either countershaft or motor drive. The friction clutch on the spindle-driving pulley is also inclosed in a cast-iron guard for keeping out the dirt and improving the general appearance of the machine.

No change has been made on the longitudinal and traverse table travels which are obtained by means of fast and slow motion handwheels operating traversing screws. Spacing of holes is obtained by means of a combination of end measures for even inches, inside micrometers for fractions of an inch, and a micrometer dial for ten thousandths of an inch. The traversing screws have no connection whatever with the measuring instrument. The same counterweighted spindle head and quill mechanism is also used, together with centralized oiling reservoirs located at various points throughout the machine.

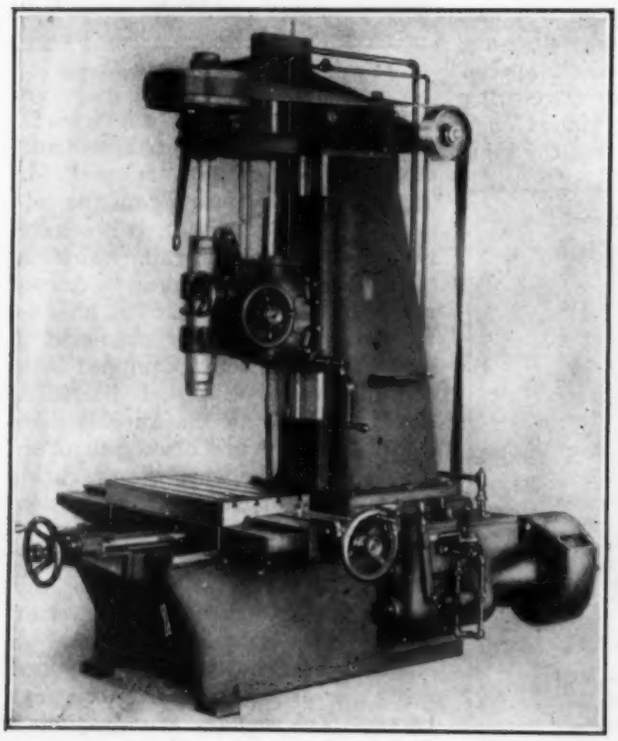
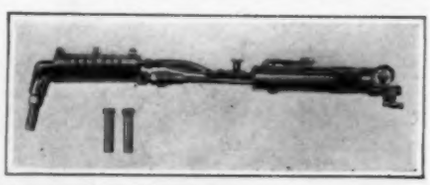


Fig. 1—Pratt & Whitney Jig Borer, Improved

Milburn Type I-G Oxy-Illuminating Gas Cutting Torch

The Alexander Milburn Co., 1416 W. Baltimore St., Baltimore, Md., has placed on the market the type I-G oxy-illuminating gas cutting torch shown in the accompanying illustration. It can be used with illuminating and by-product gases which, due to their availability and low cost, minimize the cost of operation and affords a high degree of safety. Heavy plate and slabs, risers of steel castings, structural shapes, gates, billets and general products of the steel foundry can be effectively cut with this torch.

The outstanding feature of the torch is a superheater unit that heats and expands the cutting oxygen, as well as the gases. The temperature of the cutting oxygen is raised to approximately 100 deg. C. prior to combustion and as a result it is claimed that the temperature of the gases at the torch tip are increased, the rate of flame propagation in the burning mixture is increased, but the oxygen consumption is reduced by 25 per cent or more.



Milburn Type I-G Oxy-Illuminating Gas Cutting Torch

The superheater consists of a series of copper coils, through which the oxygen passes, together with a bunsen burner contained within the torch. Further claims made for the

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superheater principle are that the heated and expanded oxygen in conjunction with the illuminating gas gives better penetration into the metal; a narrow kerf; sharp, clean edges; and speedy and smooth cutting with a notable absence of metallic slag on the underside of the cut. As a result the surfaces cut are not case hardened: they are left in practically their original state.

The torch is constructed of bronze forgings and special drawn tubing. The high-pressure cutting oxygen is controlled by means of a thumb valve, which remains fixed in either open or closed position. The arrangement of the gas tubes gives the torch considerable transverse strength. The torch is 21 in. in length and is supplied with a complete range of tips for light, medium, and heavy cutting. It is substantially built and well balanced.

Bath Nos. 2 and 2½ S.C. Universal Grinding Machine, Motor-Driven

The Universal Grinding Machine Co., Fitchburg, Mass., is marketing Nos. 2 and 2½ S.C. motor-driven universal grinding machines. Model 2 S.C. is shown in the accompanying illustration. The machines can be moved about as units and have all the features of the over-head belt driven machines without their drawbacks. A single motor drives both the wheel spindle and the table traverse mechanism.

The spindle is made of special steel, heat-treated, ground and lapped, and is 1¾ in. in diameter. It is mounted in self-aligning bronze bearings adjustable for wear. Three speeds are provided, 1,850, 2,300 and 2,800 r.p.m. The carriage carrying the spindle has a vertical movement of 7½ in. and the elevating screw is provided with a micrometer reading handwheel graduated to thousandths of inches. The standard wheel size is 12 in. in diam. x 1½ in. face. For internal work the spindle has speeds of 9,000, 11,500, and 14,000 rev. per minute.

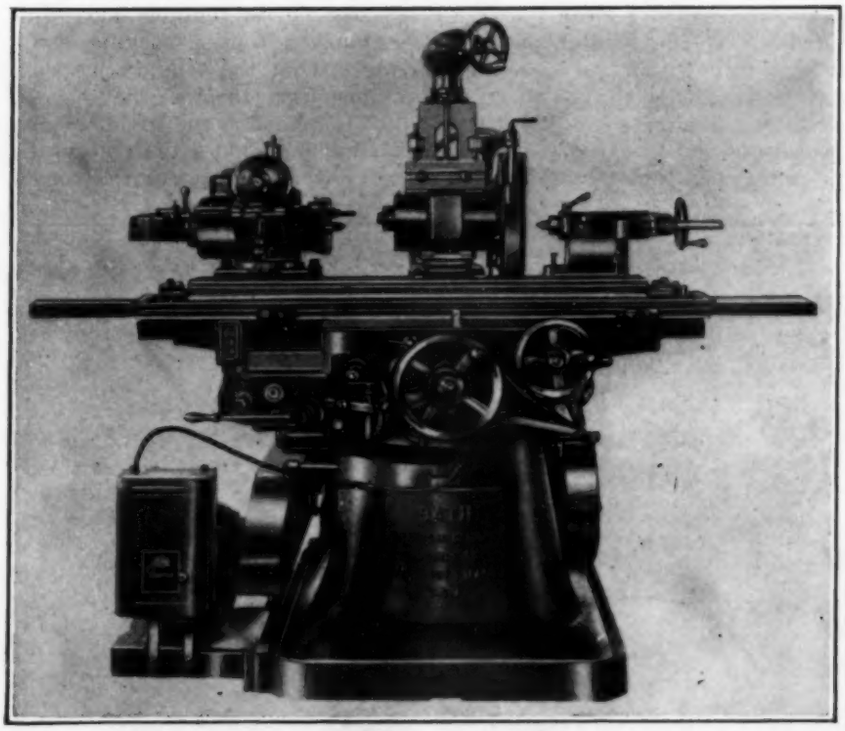
Five speeds of table traverse are provided for both cylindrical and internal grinding work of 2, 3.7, 5.2, 7.3, and 10.4 ft. per min. respectively. For cylindrical work the cross feed ranges from 0.00025 to 0.0025 at each reversal of table. The surface cross feed range is 0.0025 to 0.025 in. at either or both reversals of table. The table travel is automatic and is controlled by means of adjustable dogs. The ways have large wearing surfaces on which the oil is distributed evenly by rolls and grooves.

For taper grinding the table swivels on a central stud, hardened and ground. It can be clamped at both ends. A scale graduated in inches per foot up to 2¾ in. per ft. each side of the center is provided but the table can be moved beyond this distance for greater tapers. A V-way on the table assures alignment of headstock and footstock.

The headstock has a swivel base graduated to 90 deg. The spindle is 2 in. in diam. and is hardened, ground and lapped, and it runs in adjustable bronze bearings. For grinding on dead centers it can be locked and for chuck and face plate work it revolves, being driven through helical gears. Five changes of work speed of 64, 119, 158, 238, and 327 r.p.m. are available. The footstock spindle is also 2 in. in diam. and is controlled by means of a variable-tension spring by means of a handwheel. It also may be clamped rigidly for supporting centers.

A 3-hp. motor running at 1,725 r.p.m. furnishes the main drive for the spindle and the table. The headstock is driven by a separate ¼-hp. motor built into the head. Coolant is supplied by means of a tank and pump attached to the rear of the machine.

The No. 2 S.C. machine occupies a floor space of 114x114 in. and weighs 4,640 lb. net, while the No. 2½ machine occupies a floor space of 134x134 in. and weighs 4,920 lb.



Bath No. 2 Universal Grinding Machine, Motor-Driven

Colonial "Hy-Speed" Automatic Broach Puller

The Colonial Tool Co., 8432 Butler Ave., Detroit, Mich., is placing on the market the "Hy-Speed" automatic broach puller shown in the accompanying illustration, Fig. 1. The broach puller was designed for fast production on high-speed hydraulic broaching machines. In Fig. 2 is shown the type of broach shank that is used with the puller.

When the broach is inserted in the "Hy-Speed" puller, the two keys

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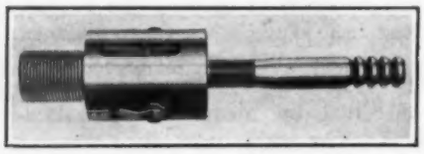


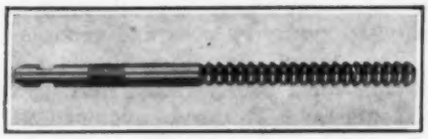
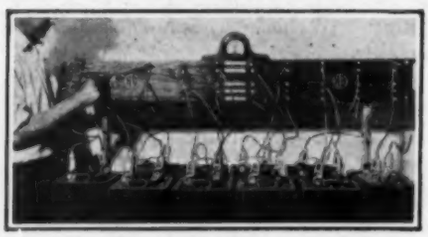


Fig. 1—Colonial "Hy-Speed" Broach Puller. Fig. 2—Shank design

automatically drop into the flats of the broach shank, locking it into place. To remove the broach from the puller, the operator turns the broach a quarter way around. This movement pushes back the key so that the broach can be removed with ease. It is claimed that with this puller all unnecessary moves on the part of the operator are eliminated. Broaches with other types of shank can be converted readily to fit the puller. The "Hy-Speed" puller is regularly carried in sizes from ½ in. to 1⅝ in. Other sizes are furnished as specified.

"HB" Battery Charging Panel

Hobart Bros. Co., Troy, Ohio, is marketing the battery charging panel shown in the accompanying illustration. In design, it resembles a telephone switchboard in that plugs are



"HB" Battery Charging Panel

used instead of knife switches.

This charging panel contains four separate lines: One line carries the regular charging current; the second line gives the ammeter reading of any battery plugged in on it; the third provides a resistance of 5 amperes for batteries that require it, while the fourth provides a resistance of 10 amperes. All lines are plainly marked.

Ten batteries can be handled at one time. Complete equipment includes special plug-equipped leads.

Westinghouse Automatic Electric-Arc Seam Welder

The automatic electric-arc seam welder, shown in the accompanying illustration, Fig. 1, has been designed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The machine consists of a traveling "Auto Arc," and a cast-steel framework for carrying the arc and for holding the material in place.. The welder will hold tanks or drums ranging in size from 10 to 40 in. in diameter, and up to 8 ft. in length.

The "Auto Arc" strikes the arc automatically, and if necessary will exert a pull of 200 lb. in order to prevent fusion of the electrode wire to the work. The welding wire is fed automatically to the work at any speed up to 3 ft. per min., and the machine maintains a constant arc length and a constant arc voltage. The "Auto Arc" is intended to relieve the operator of the tiresome hand labor of maintaining the arc and feeding the welding wire. It is claimed that a better weld is obtained, and the metal can be deposited faster than by hand welding.

The arc length can be adjusted to maintain an average of 15 to 20 volts. Any size wire up to ⅛ in. can be fed. The ¼-hp. motor and the electromagnets obtain their power independently of the arc circuit. The automatic welding equipment is especially designed for the welding of long continuous seams, but it can also be used effectively for many manufacturing operations and repair jobs.

The section of the pipe or tank drum to be welded is easily inserted between the two sections of a clamp-

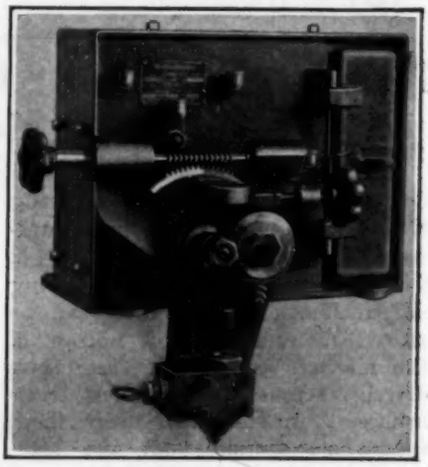


Fig. 1—Westinghouse Automatic Electric-Arc Seam Welder

ing device, which is in the form of an extended arm balanced by a cast-steel base. The lower half of the clamping device contains air cylinders, and a copper backing strip. After placing the tank in position, the operator throws the handle, which is located at the left of the extended arm. This action raises the air cylinder and presses the copper

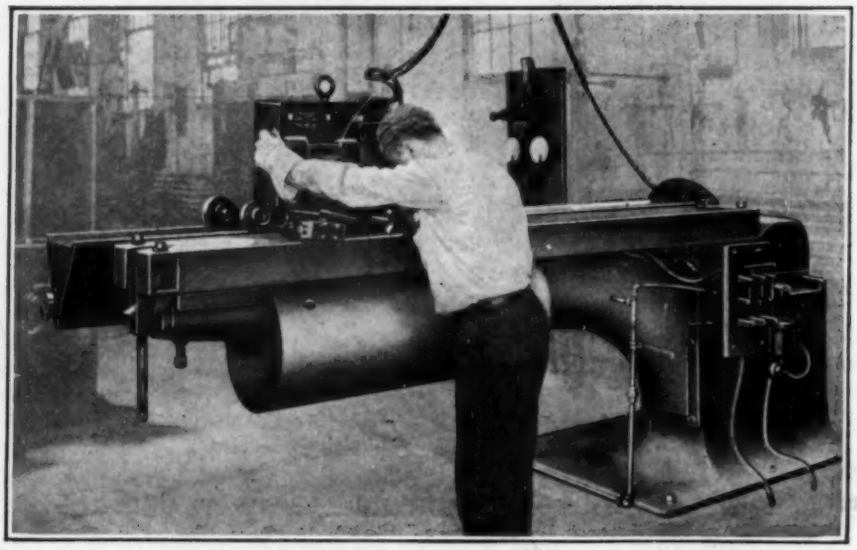


Fig. 2—Welding a tank with the Automatic-Arc Seam Welder

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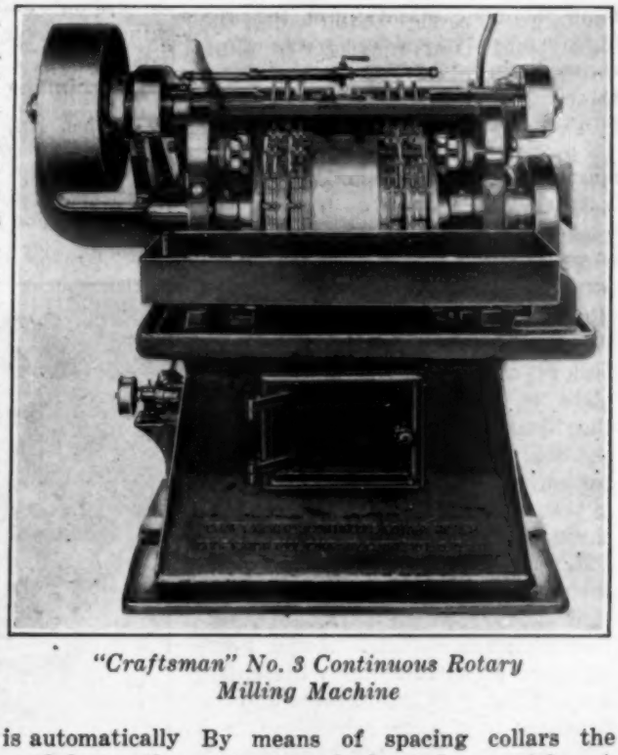
backing strip against the tank, holding it firmly in place.

The "Auto Arc" is mounted on a traveling carriage having 4 grooved wheels that move along a track on the extended arm of the tool. It is propelled along this track by means of a ¾-hp. motor mounted on the arc base and geared to the wheels of the traveling carriage. In Fig. 2 the machine is shown in operation.

When the operator is ready to begin the weld, he throws a switch to start the motor and another one to start the "Auto Arc." The latter then moves along the seam, automatically welding it. The motion of the "Auto Arc" can be reversed at any point, and adjustments for irregularities in the seam can be made by means of a handwheel that adjusts the welding wire directly on the seam. It is claimed that with this welder seams up to ⅜ in. in thickness can be welded at speeds from 14 to 25 in. per minute.

"Craftsman" No. 3 Continuous Rotary Milling Machine

The Equipment Manufacturing Co., Leader-News Bldg., Cleveland, Ohio, is marketing the "Craftsman" No. 3 continuous rotary milling machine shown in the accompanying illustration. The chuck rotates continually and the work is inserted by hand. The standard chuck is arranged for castellating of S.A.E. nuts and screw slots, but chucks having receptacles for almost any class of work can be obtained. Slab milling, straddle milling and plain milling can be performed, and as many as four articles can be milled at the same time. Production is largely limited by the rate at which the operator can feed the machine.



"Craftsman" No. 3 Continuous Rotary Milling Machine

The work is milled by being fed into the cutters in continuous succession. Cutting on one piece starts before the previous piece is completed. On approaching the cutters, each independent jaw of the chuck is automatically closed, and after the work leaves the cutters a spreader opens the chuck and releases the work into a chute.

The chuck is 16 in. in diam, and is driven by means of a worm and wheel controlled by a clutch. Change gears in the train provide thirty feeds to the chuck. Parts up to 2½ in. in diam. by 6 in. in length can be accommodated.

Two independent cutter spindles are provided, each mounted on rocker arms so as to vary the depth of cut. The cutters are carried on hardened and ground steel spindles 1½ in. in diam. mounted in bronze bushings and driven by means of spur gears. By means of spacing collars the cutters can be located accurately. A single pulley 20 in. in diam. by 6 in. face is used to drive both spindles and the work chuck. An additional pulley 18 in. in diam. is used to drive the back gears on the spindle for heavy-duty work.

The frame of the machine is of heavy castings which rest upon a substantial cast-iron base. The machine occupies an extreme floor space of 5 ft. 8 in. by 3 ft. 6 in. The heights is 5 ft. 6 in., and the shipping weight is 3,400 pounds net.

Vernier Attachment for "Tri-Way" Boring Machines

The Universal Boring Machine Company, Hudson, Mass., is offering as special equipment to their Nos. 24 and 44 "Tri-Way" boring machines, the vernier attachment shown in the accompanying illustrations. Fig. 1 shows the vernier attached to the table, while Fig. 2 shows the type of vernier attached to the head.

The vernier plate proper is mounted upon an adjustable plunger that has a movement slightly greater than 1 in. Adjustment is provided by means of a standard forty-pitch micrometer screw so that it is possible to secure accurate settings of the vernier. By means of a locking screw the vernier is held firmly in position so as to prevent accidental movement.

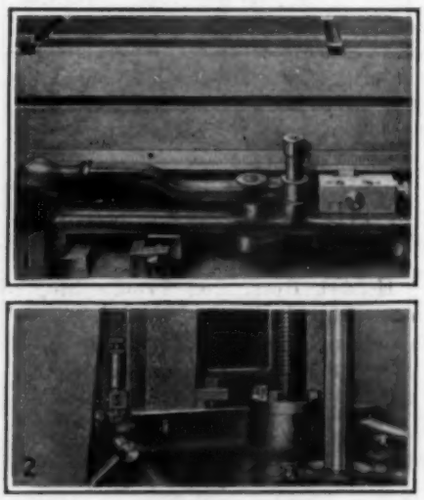


Fig. 1—Vernier Attachment on table of "Tri-Way" Boring Machine
Fig. 2—Vernier Attachment on head

With this attachment holes can be bored accurately long after the feed screws have lost their initial accuracy. The verniers do not interfere with the regular operation of the machine and may be used to check settings obtained by means of the regular screw-actuated feeds.

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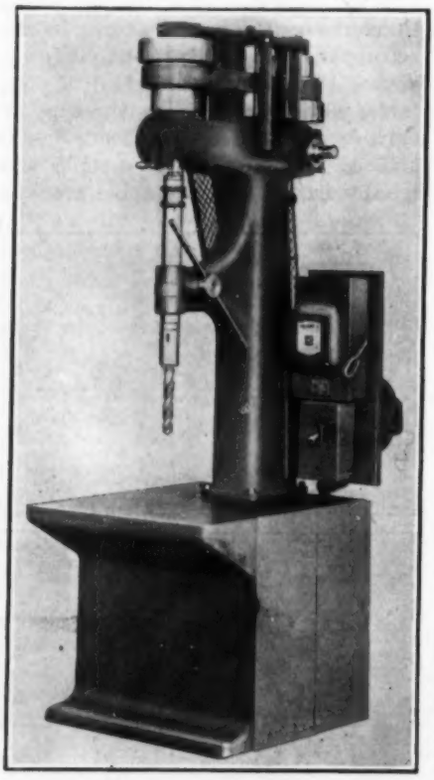
"Footburt" No. 3 Sensitive Drilling Machine

The No. 3 "Footburt" sensitive drilling machine shown in the accompanying illustration is being marketed by the Foote-Burt Co., Cleveland, Ohio. This size has a capacity for drilling 1¼-in. holes in cast iron or ¾-in. holes in steel. It has many of the features of the smaller-capacity sensitive drilling machines made by this company, such as a quick-change speed arrangement, a simple drive and automatic swinging idlers. It is intended for production work.



"Footburt" No. 3 Sensitive Drilling Machine

Due to the length of spindle travel, it has been possible to eliminate the usual spindle bracket with vertical adjustment and adjustable table such as are used on drilling machines of this capacity. The machine is designed to be set up for one particular type of job, although it is possible to use various types of jigs on the box type table where necessary.

The distance between the spindle nose and the top of the table can be set to suit the requirements of the individual purchaser. If it is desired, a filler block can be placed under the upright to increase this distance.

The spindle is made from high-carbon steel and is mounted in bronze bushings in the spindle sleeve. It is 1⅜ in. in diameter at the driving end and is bored to receive a No. 3 Morse taper. Two keyways are used for driving.

An important feature of this machine is the design of the cabinet base which is arranged so that two or more machines can be bolted together, thereby forming a gang machine, with a distance of 15 in. between the spindle centers. Additional units can be added as the production increases. With this arrangement a great deal of floor space can be saved. When so interconnected the machines can be arranged for a single drive where the cut taken by each is not too large. The right hand end of the pulley shaft is arranged for coupling to the left hand end of the drive shaft of the next unit, and so on.

Three spindle speeds are provided by means of a 3-step cone pulley. These speeds may be selected by operating a handle located at the front of the machine.

The machine can be arranged for either belt or motor drive. In the illustration motor drive is shown. When belt driven, the tight and loose pulleys are mounted in the same place as the single pulley shown in the illustration. The remainder of the drive is simple, and is the same for both belt and motor drive. Power is transmitted from the pulley shaft through a set of spiral bevel gears to the rear vertical cone pulley, then through the endless belt to the front cone pulley, which is mounted directly on the spindle. Roller bearings are used throughout the entire unit. The set of spiral gears and the bearings in the gear box run in a bath of oil. All other bearings are lubricated by means of the Alemite System.

The swinging idler pulley, located on the slack side of the belt, automatically takes up the slack. The greater the pull placed on the belt, the more it tends to wrap the belt around the driving cone, thus insuring a maximum driving power from the belt. This belt is endless and is 2½ in. in width.

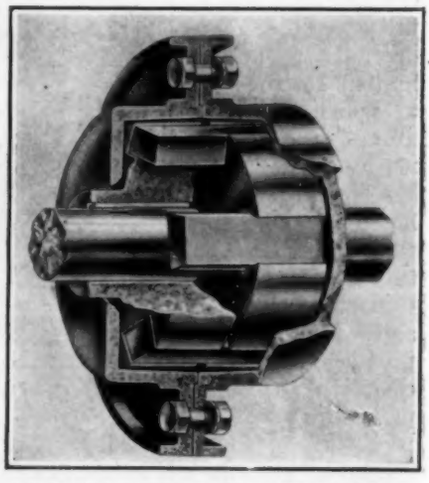
Both vertical cone pulleys are solid and hence have considerable flywheel effect so that stalling is prevented when the drill starts into the work. Because they are solid, they are well balanced and hence will not cause any irregularity in the cut, even at high speeds.

It is possible to equip this machine with automatic power feed, similar to that used on the BW and BX "Footburt" Sensitive Drilling Machines.

Nicholson Flexible Shaft Coupling

The flexible shaft coupling shown in the accompanying illustration is being marketed by W. H. Nicholson & Co., Wilkes-Barre, Pa. It has been designed to compensate for any reasonable misalignment and to permit a liberal amount of lateral float as well. Metal construction is used throughout and the parts are machined all over so that they are in balance.

The coupling consists of two cast-steel hubs which are keyed to their respective shafts, and in which dovetail slots are cut to receive floating steel keys having beveled sides. Three of these floating keys are used in the smaller couplings, while in the larger sizes, five are used. These working parts of the coupling are inclosed in a cast-iron casing made in two halves, and bolted together with a gasket between. This casing is firmly secured to one hub, and besides keeping dust and dirt out



Nicholson Flexible Shaft Coupling

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and the oil in, it limits the lateral movement of the floating keys in the slots. Between each floating key and the slot in the hub there is a definite clearance that permits an error of alignment between the two shafts equal to approximately twice this clearance. The amount of this clearance varies with different size couplings but is sufficient to compensate for any reasonable amount of misalignment found in practice. When the couplings connect two misaligned shafts, the keys have a slight rocking action during each revolution so that wear is not localized but is distributed evenly across the side surfaces of the keys. It is said that the pressure caused by the centrifugal force maintains an oil film between the keys and the slots thus preventing metal-to-metal contact.

The keys are said to remain noiseless due to the fact that centrifugal force keeps them constantly thrown out into the dovetail slots. When torsional load is applied the keys are forced down and drive on the bottom of the slots, but as soon as the load is relieved centrifugal force returns them to their original position. An oil filling plug is provided for filling the coupling with lubricant.

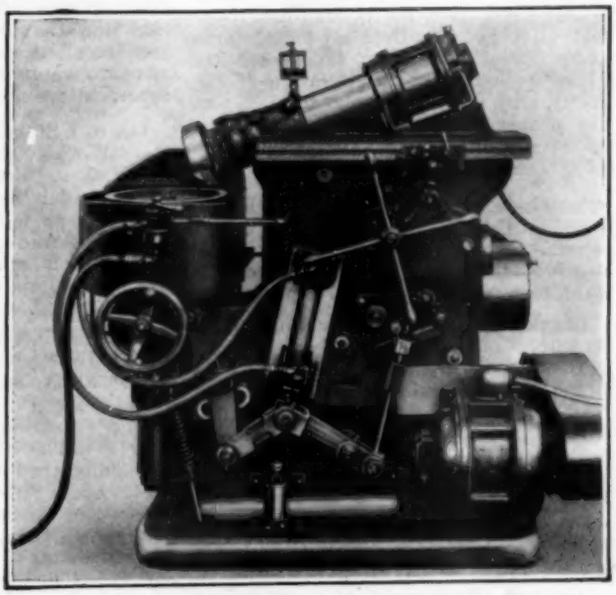
The coupling is made in 16 sizes and for shafts ranging from ½ to 12 in. in diameter. No capacity rating is given for the couplings since the floating keys are of such dimensions that they will transmit more torque than the shaft itself and the shaft key for which the coupling has been designed. A single size of coupling will accommodate a wide range of shafts, the bore being variable.

Pneumatic Lift for Work Spindle of Heald Surface-Grinding Machine

For the purpose of grinding a plane surface at the bottom of a recess, the Heald Machine, Co., Worcester, Mass., has added a feature to its rotary surface-grinding machines by means of which the work spindle may be raised vertically through a definitely controlled distance.

The movement is brought about by the application of compressed air. The piston of the inclined cylinder to be seen on the side of the machine in the accompanying illustration is connected directly to the knuckle of a pair of toggle levers that act, through the medium of a bell-crank, to raise the work-carrying head. A maximum lift of 2 in. at the chuck is available, and the distance may accurately be determined and controlled to any amount less than this dimension by means of an adjustable anvil-screw against which the knuckle of the toggle levers strike when the piston is depressed. Attached to the lever at the right is a connection by means of which the rotative movement of the chuck and the reciprocations of the ram are started and stopped.

The operator has thus only to load the chuck and manipulate the air valve. As the piston is depressed in the air cylinder, the work head rises until the set distance is reached, when the knuckle contacts with the anvil-screw. At the same time the connection between the toggle levers and the control box has set the other parts in motion.



Pneumatic lift for work spindle of Heald Surface-Grinding Machine

In the illustration, the piece in the chuck is the flywheel of an automotive engine, and the operation is to grind the plane surface of the web. To reach this surface with the grinding wheel it is necessary to elevate the work nearly 2 in. after the wheel has passed over the rim of the flywheel, a tedious job to do with the handwheel, but a rapid one with the device shown. This pneumatic lift does not, however, interfere in any way with the vertical adjustments that may be made at any time with the handwheel.

A further feature of the machine is the inclined auxiliary slide, mounted upon and moving with the main ram, on which the wheel spindle is carried. Because of the angular relation of the wheel spindle to the axis of the work, it is possible to present the grinding wheel to the work in such manner that the cut may be carried, without interference, to the junction of the plane with the cylindrical surfaces where the web meets the rim. The periphery of the grinding wheel is, of course, dressed at an angle equal to the angle of inclination of the wheel spindle.

Gardner Motor-Driven Polishing Lathe, No. 3-CA

The motor driven polishing lathe shown in the accompanying illustration is being manufactured by the Gardner Machine Co., Beloit, Wis. It is claimed that the mounting of the motor on a hinged bracket at the rear of the base has a number of advantages. The spindle is belted to the motor, and with this type of drive almost any reasonable spindle speed can be secured, depending upon the size of the motor pulley. Because the motor is mounted on a hinged bracket the belt length need not be varied to take care of different sizes of pulleys. The belt is fully inclosed in a sheet metal guard and is run tight at all times.

This method of construction is said to conserve floor space and to make a self-contained unit that may be installed at any point. An alternating-current motor is used, op-

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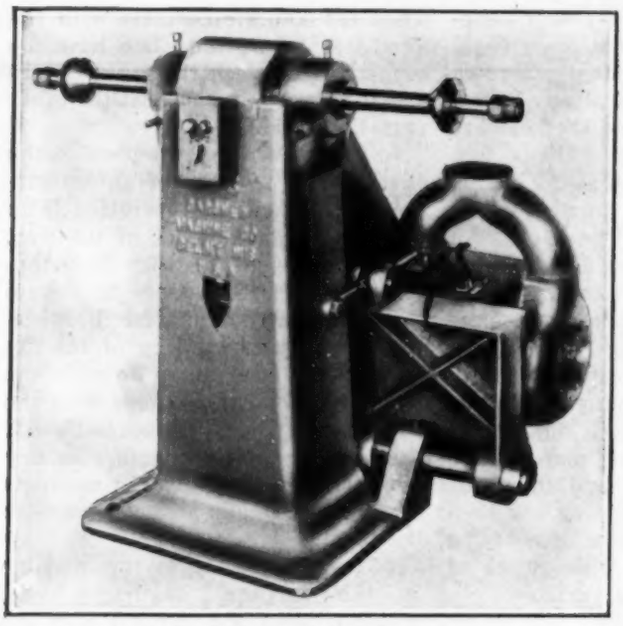


Gardner No. 3-CA Motor-Driven Polishing Machine

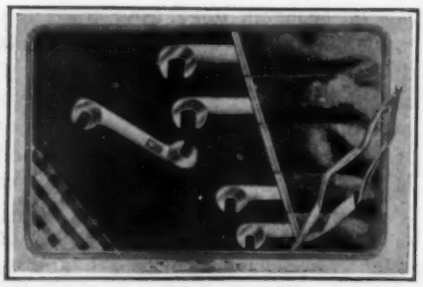
erated by means of a push-button station built into the base. The starter unit proper can be mounted on a nearby wall.

In general construction, this machine is identical with the standard No. 3 belt-driven polishing lathe made by this company. The spindle is of ample proportions and is mounted upon high-grade ball bearings, fully inclosed in dust-proof housings. The housings are provided with double-capped oil holes, as well as a lubrication-chamber drain carefully capped to exclude dust and dirt.

Bonney Chrome-Vanadium Right-Angle Wrenches

The chrome-vanadium right-angle wrench set shown in the accompanying illustration is being marketed by the Bonney Forge & Tool Works, Allentown, Pa. These wrenches have a 90-deg. angle of opening and are designed for work in close quarters, where it is impossible to use a 15- or 22½-deg. opening. Advantage is taken of the strength of chrome-vanadium steel to make the heads of the wrenches pear-shaped so that they may easily get into close corners.

The handles are shaped to give the operator a comfortable grip, and are finished in nickel with polished heads. They are made in all standard combinations of openings from $\frac{7}{16}$ to $\frac{7}{8}$ in. Each wrench is guaranteed to strip the thread of any standard nut, or to break the bolt before the jaws will spread. These wrenches may be purchased separately or can be put up in a leatherette kit, as shown in the illustration.



Bonney Chrome-Vanadium Right-Angle Wrenches

Trade Catalogs

Babbitt, Lead-Base. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has published a small 16-page pamphlet on its lead-base babbitt, alloy No. 25. Detailed instructions as to the proper use of this metal are given, including the preparation of the shells, such as cleaning and tinning, and the proper use of mandrels. Methods of overcoming various defects in the cast metal are also given.

Bearings, Roller. The Timken Roller Bearing Co., Canton, Ohio, has issued several correction sheets for its *Engineering Journal* which was recently published.

Chucks. The Skinner Chuck Co., New Britain, Conn., has published Bulletin No. 40-A. It contains 14 pages bound in loose-leaf form in a paper cover. The "Air Operated" wrenchless chucks made by this company are described and illustrated by means of numerous photographs. The air valve used in connection with these chucks is also described, as is the double-acting ball bearing air cylinder. Complete specifications are given.

Control Equipment for Charging Storage Batteries. The General Electric Co., Schenectady, N. Y., has issued a 4-page leaflet in which its apparatus for the control of the charging of storage batteries is described and illustrated by means of numerous photograph. The chief features of each piece of apparatus are pointed out.

Coupling, Flexible. The W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa., have published bulletin No. 1026 on their improved flexible coupling, which has just been placed on the market. A complete technical description of the construction of the coupling is given, aided by a phantom view of the device and photographs of the various parts, together with cross-sectional views. Complete specifications are given.

Electrical Specialties. McGill Manufacturing Co., Valparaiso, Ind., has issued its catalog No. 21. Most of the space is devoted to describing the various types of lamp guards for both fixed and portable use. Various types of switches are also described. The catalog is very completely illustrated.

"Fahralloy" Castings. The Southern Manganese Steel Co., 6,600 Ridge Ave., St. Louis, Mo., has issued a bulletin on its "Fahralloy" castings for high-temperature and corrosive processes. A general discussion of the mechanical properties of metals at high temperatures is first given, followed by an exposition of the properties of this alloy that make it suitable for high-temperature work. Its general characteristics are described and its thermal expansion and conductivity are discussed. Numerous examples of typical applications of this metal are then given. The booklet is very completely illustrated, and includes photographs of the various plants of this company.

Fans, Exhaust. The Macleod Co., Cincinnati, Ohio, has published a leaflet on the Macleod-Keeney "Everlasting" exhaust fans. The principle of operation and the construction of the fans are described and illustrated by means of photographs and line cuts. Complete specifications and ratings are given.

Gears, Standardized. The Boston Gear Works Sales Co., Norfolk Downs, Mass., has published a bulletin on its parallel drives. Standard spur and helical gear units are listed, together with racks and internal gear sets. Complete specifications are given. Some engineering data and information are also included.

Lathes, Universal Turret. The Warner & Swasey Co., Cleveland, Ohio, has issued a 16-page, 8½x11-in. bulletin entitled "Net Profits from Small Lots." Numerous examples are given to show how a universal turret lathe can economically turn out parts in small lots of 5 to 15 pieces. Four points are stressed: Keeping the machine busy, low set-up time, faster production, and low investment in machine and tools. A typical financial problem is given to show how profits can be made. The bulletin is well illustrated by means of line cuts and halftones.

News of the Week

Hoover Reports Steady Progress on Elimination of Waste Program

Outlines the results of five years of study and effort

Secretary of Commerce Herbert Hoover, in his annual report on the work of the Department of Commerce, states that steady progress is being made in the elimination of waste in production and distribution. The Department of Commerce has devoted much of its activity in the past five years to this work.

Secretary Hoover sums up this work in the following introduction to his report:

While various divisions of the department have been actively aiding in the campaign in many specific directions, it must be borne in mind that the whole program is one fundamentally to stimulate action among industries, trades, and consumers themselves. It is obviously not the function of government to manage business, but for it to recruit and distribute economic information; to investigate economic and scientific problems; to point out the remedy for economic failure or the road to progress; to inspire and assist in co-operative action in reduction of waste—surely all these are well within the proper field of public service.

Maintaining American Standards

It seems worth while at all times to reiterate the fundamental purposes of this campaign. The objectives which underlie it have but one purpose; that is, to maintain American standards of living for both workers and farmers, and to place production on a more stable footing by enlarging consumption and export markets through reduced production and distribution costs. The high standards of living enjoyed by the American people are the result of steadily mounting per capita productivity. There is only one way further to advance these standards, and that is by improved methods and processes, by the elimination of waste in materials and motion in our production and distribution system. The moral and intellectual progress of the Nation is not the offspring of poverty or low living standards. The incentives to crime decrease with increasing security; the opportunity for education, and the growth of understanding are the products of economic progress—not of economic degeneration. Devotion to economic improvement whether in individual effort or in improved methods enlarges the field of leadership; it is not a stimulant of idle or luxurious living.

Just as 20 years ago we undertook nation-wide conservation of our natural resources, so we must to-day even more vigorously sustain this campaign of better nation-wide utilization of our industrial resources and effort. More especially is this the case in view of the many complex forces which have arisen from the war, and particularly the difficulty of maintaining our situation as against the competition of a world of lower standards overseas.

The term "elimination of waste" is subject to some objection as carrying the implication of individual or willful waste. In the sense used in these discussions elimination of waste refers wholly to those wastes which can be eliminated solely by co-operative action in the community. It does not refer to any single producer, for in the matters here discussed he is individually helpless to effect the remedy. Nor does the elimination of such waste imply any lessening of fair competition or any infringement of the restraint of trade laws. In fact, the most casual investigation of the work in progress will show that its accomplishment establishes more healthy competition. It protects and preserves the smaller units in the business world. Its results are an asset alike to worker, farmer, consumer and business man.

Ten Phases of Progress

The report enumerates some of the accomplishments in the effort to eliminate waste in essential industries. Some of the points covered which show the scope of the work and the importance of the results are:

(1) Elimination of the waste imposed by inadequate railway transportation, by improved equipment and methods, and the establishment of better co-operation.

(2) Vigorous utilization of our water resources for cheaper transportation of bulk commodities, flood control, reclamation, and power.

(3) Enlarged electrification of the country for the saving of fuel and labor.

(4) Reduction of the great waste of booms and slumps of the "business cycle" with their intermittent waves of unemployed and bankruptcy.

(5) Reduction of seasonal variations in employment in construction and other industries.

(6) Reduction of waste in manufacture and distribution through the establishment of standards of quality, simplification of grades, dimensions, and performance in non-style articles of commerce; through the reduction of unnecessary varieties; through more uniform business documents such as specifications, bills of lading, warehouse receipts, etc.

(7) Development of pure and applied scientific research as the foundation of genuine labor-saving devices, better processes, and sounder methods.

(8) Development of co-operative marketing and better terminal facilities for agricultural products in order to reduce the waste in agricultural distribution.

(9) Stimulation of commercial arbitration in order to eliminate the wastes of litigation.

(10) Reduction of the waste arising from industrial strife between employers and employees.

Philadelphia Celebrates Management Week

Financial losses suffered by American industries through avoidable waste, was the subject of a series of conferences during Management Week in Philadelphia. The programs were participated in by engineers and industrial leaders of the city, and were sponsored by the American Society of Mechanical Engineers and the United States Department of Commerce.

W. Chattin Wetherill, representing the Department of Commerce, was the speaker at the closing session, the other sessions being addressed by engineers, builders, architects, labor chiefs, railroad executives and insurance company representatives.

The series opened at the Franklin Institute on Oct. 25, when C. William Johnson, assistant secretary of the Insurance Co. of North America, discussed the problem of waste elimination from the standpoint of fire losses.

In discussing the general subject of waste, Mr. Wetherill presented a table showing that the lowest percentage of waste is in the metal trades.

Morris L. Cooke, director of the Pennsylvania Giant Power Survey, who presided at the third session, told the engineers that co-operation between employees and employers is an essential if waste is to be reduced materially.

During the discussion of the waste question of public utilities, Philip H. Gadsden, vice-president of the United Gas Improvement Co., asserted "We in the public utility business are industriously following out the theory of mass production. Throughout the country in thirty-seven states, we have information bureaus designed to carry out the idea of advertising public service. We have recognized that in economic structure, all public utilities belong to one family."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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ELECTION is over and has left no ruins other than those of political hopes. It failed to disturb "The Street," and those who sold stocks on the theory that it would unsettle values were disappointed.

The Democrats have gained seven seats in the Senate and now have 47. Those who call themselves Republicans have the same number, and Farmer-Labor has one. A vacancy exists in Maine which will probably be filled by a Republican.

But the changes made are not very important. On many questions the nominal Republicans in the "progressive" group will vote with the Democrats, as heretofore, and the chief difference is that their hold on the balance of power has been made tighter. The Democratic gains in the House do not disturb the Republican majority and even partisans who think that only Republican rule can be beneficent may reassure themselves by remembering that the new Congress does not meet until the first Monday in December, 1927, unless called in special session sooner. In the intervening thirteen months the political changes effected will probably be forgotten.

Nor are any of the more spectacular results of the vote, including the defeat of Senator Butler and the "wet" victories in the prohibition referenda, of economic importance. Therefore, business can and should ignore the elections and resume the consideration of its most important problem, which is "How long will the present activity last?"

Something of a tug-of-war is going on between those who say that such a year as 1926 has been must unavoidably be followed by a reaction, and others who argue that credit stability, scientific business management, hand to mouth buying, improved merchandising and advertising, and the technical progress in production methods have ushered in an era in which the downward swings of business are no longer inevitable. The contentions of these latter optimists are doubtless true in part, but I should advise no one to rely upon them unreservedly, for it is impossible to run even the most perfect machine at top speed indefinitely, and a little caution at present would be a governor that might prevent breakdown of the business organism.

The monthly reviews of the nation's business issued by the great banks take a cheerful view of the outlook for the remainder of this year but seem dubious about 1927. Dun's reports that bank clearings in principal cities last week were lower than in 1925, although during most of the year to date they have run substantially ahead. The Chicago mail order stores report a decline in October business as compared with last year, a contraction of the steel trade is evident although pig iron is active at advancing prices because of higher coal, and some of the commodity markets are droopy. These may be indications of slight business contraction, but if so, it may be viewed gratefully as an application of restraint that will prevent a more serious reaction later. Speaking generally, I think that 1927 will be a boomless year, but there is no indication and no likelihood that it will be essentially unprosperous.

What's Doing in Industry

Business in machinery and machine tools in the first ten days of November has given reason for a feeling of optimism in most of the important industrial centers of the country. Of course, conditions are still spotty and most orders are for small quantities, but this is a seasonal condition that usually precedes the first of the new year.

Chicago reports a definite improvement this month so far, with pending inquiries promising a good volume. Detroit is feeling the seasonal slump in automotive activity, which will disappear with the announcement of new models for the next year. A slight increase in sales and a more active market generally is reported from Cincinnati, while Milwaukee dealers are moderately active on new business. Orders have dropped off in Cleveland but factories are busy on previous bookings.

Machinery business is picking up in New York, most dealers reporting prospects good for immediate closing of some fair orders. Up-state in the Buffalo district business is not as active as was expected, although prospects are better than they were last month. Sales continue brisk in Philadelphia and new inquiries are appearing regularly.

Election is over and has left no ruins other than political hopes. Business can and should ignore the elections and resume the consideration of its most important problem, which is—"How long will the present activity last?"

Going over the picture in more detail, the money markets are well balanced and with the resources of the Federal Reserve Banks still almost untouched and security market needs declining no advance in rates is to be expected other than the seasonal firming that comes with the holidays. Car loadings are still at the peak for all time and trade volume continues high with mixed conditions reported only in the South and Southwest as a reflection of the low price of cotton. But cotton represents a comparatively small proportion of the South's purchasing power, good prices are being received for tobacco and the truck produce that are her other principal agricultural products, the big crop assures greater earnings to all who handle it and greater mill activity, and the lower prices for goods will expand their consumption as well as leave a greater share of the income of other parts of the country for other purchases. And as the market demonstrates that farmers will hold their cotton at present levels, while many mills are covering their requirements far ahead, the first panic that attended the price drop is departing from both the South and purveyors to it. Gray goods continue active, with print clothes taking the lead, and ginghams are better.

Fifteen small private banks in Michigan were closed last week as a result of frozen loans, bad crops and a steady withdrawal of deposits, but eighteen of Florida's 39 banks closed in the collapse of the land boom have reopened.

Among the commodities the price trend seems to be slightly upward, although some of the basic groups are exceptions. The soft coal boom, child of the British strike; goes serenely on while oil prices yield under heavy production figures. Rubber rallied strongly toward the end of the week because the British effort is to maintain a price of 48 cents next year.

The firmness of sugar has been renewed on the steadily improving statistical position, and coffee apparently has struck a point of resistance in its decline. The position of the grains is difficult to analyze. Corn is weak and wheat shows strength at times although many merchants believe it is held up only by the rise in European markets.

October's building record as compiled by the F. W. Dodge Corporation shows a decline of 8 per cent in contracts awarded as compared with September and 3 per cent as compared with a year ago, but the *Engineering News-Record*, reporting only large construction contracts, sees such building maintained at a better pace than last year.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Buffalo

October, relatively speaking, was a month of low volume in the Buffalo machine tool trade. This was true in all branches of the business. In some instances the October business was not as good as that of September. Some believe that there will be an improvement, now that election is over, but there are others who do not expect a pick-up until after January first.

Even if November and December produce but a very low volume of business in almost every instance, the business year will close better than did 1925.

As figures stand now, the second quarter was by far the best, with the first month of the third quarter also very good. In some cases the volume of business which some companies report for this year is very much better than last, one reporting an increase of fully 150 per cent.

Inquiries are slightly better than a month ago. And inquiries from points outside of Buffalo, notably Rochester, are better than in the city itself.

Dealers in contractors' supplies report a splendid business in sight for snow-removal equipment during the next few weeks.

The movement of electrical equipment is slower now than at any time during the year.

New York

Business in machinery and machine tools is picking up in this market. Orders that were held up last month, for reasons somewhat hard to understand, are now being confirmed and prospects are that this month will show a substantial amount of business.

Inquiries have been received by dealers and agents in greater quantity than in some weeks past, and it is the general opinion that many of these will be fruitful of orders before the end of the year. The greater number of these inquiries are for one or two machines, but there are a few scattered lists that call for a fair amount of equipment.

Railroads have been in the market in the past week, purchases having been recorded by the Lehigh & Hudson R.R., the New York Central, the Illinois Central and the Commonwealth Street Ry. Other business came from large industrialists, including the Carnegie Steel Corporation, Waltham Watch Co., Victor Talking Machine Co., Reo Motor Car Co., Dodge Bros., Barnes Drill Co., Knowles Tool Works and the Baird Machine Co. The tools ordered included radial drills, lathes, car-wheel borers, jig boring machines, hand millers, and bench drills. The order from Dodge Bros. is reported to be of a very substantial nature and included many types of machines, the total amount of the order running into more than a hundred thousand dollars.

Milwaukee

New business in metal-working equipment is moderately active, although some plants report a gradual slowing down. This, however, is largely a surface indication, orders being of relatively satisfactory volume, but the heavy pressure for quick delivery has lessened. Automobile factories are placing some good orders which embrace delivery specifications between now and early spring, when production is increased. This business is confidently expected to continue until the end of the year, and it will serve to keep machine tool shops busy for several months ahead.

The general situation in the metal-working trade of Milwaukee is considered favorable. Skilled labor continues to be fully employed, and some shops still complain of a scarcity of desirable men. There has been a slight falling off in the number at work in all lines, but this is a seasonal decline and it is hardly as severe as it was a year ago. Industry looks for an active winter season, despite the fact that automobile production is slackening perceptibly. However, the reduction in output appears somewhat sharper than usual because of the exceptionally high rate of production in August, September and October.

A few tools are being purchased by railroad shops, but this class of business has not yet reached the level promised by the outlook. The electrical industry is becoming more active in the acquisition of equipment. Replacement business in all lines is heavier than it has been in several months.

Detroit

A seasonal slump in the machinery and machine tool market in Detroit and other automobile centers in southeastern Michigan has set in, and indications are that there will be no material change in present conditions before the first of the year when the automobile shows present their offerings to the buying public.

The chief factor in this slump is the decision on the part of automotive executives to postpone the inauguration of any expansion program until 1927. None are completely out of the market for tools and equipment, but the sales are usually for single machines here and there.

According to local machine tool dealers the emergency, and the ability of the manufacturer to supply the machine wanted immediately, are the determining factors in most of the sales made in November.

Standard equipment is moving at a more or less even pace. Several milling machines, grinders, radial drills and shapers have been sold recently, but with few exceptions they are single orders.

Cleveland

Many local machine tool manufacturers admit a drop in the number of orders and inquiries for the current month. They do not, however, view the situation with pessimism. Production continues above normal, as many orders of several months standing still remain unfilled. Most of the local producers have been obliged to work overtime during part of the summer and early fall in order to keep up with the demand, but at present they are gradually settling down to normal.

The automotive and general jobbing industries have somewhat retarded their activities during the past few weeks, which reflects back on the machine tool industry. No predictions as to the balance of the year are offered, but the opinion prevails generally, that business will pick up after the first of the year. Comparatively speaking, this year has been much better, month for month, than any since the war, and it is believed that business has returned to a fairly even keel.

Cincinnati

A majority of Cincinnati machine tool manufacturers report a slight increase in sales in the past week. None report a decrease in the demand and the prevailing opinion is that the market trend will continue upward.

Selling agents report that the market has become livelier than in the previous week and the prediction is that conditions will continue to improve. Inquiries, it is stated, are coming in in a most encouraging way, both for immediate requirements and for deliveries after the first of the year.

The greater portion of the week's orders were for single tools and replacements, these being well diversified as to sizes and types of tools and coming from all parts of the country. Railroads did very little buying, but sent in a fair number of inquiries. Concerns in the automotive industries did little buying, the purchases being confined to single tools and replacements. One manufacturer reports several sales in the Southwest, to concerns in the oil field.

A feature that several manufacturers have pointed out is the fact that several machine tool concerns have been buying high-efficiency equipment for their own use, with a view to cutting costs and at the same time increasing production. All of the machine tool plants are busy and production is being maintained at a good level.

Philadelphia

Indications point to continued activity during the balance of the year among producers and dealers in machinery and machine tools throughout the Philadelphia area. Sales continue to be brisk, with inquiries coming from a well scattered area and from a diversified list of industries.

Among the Eastern and Middle-Western railroads, manufacturers found a good market for horizontal boring mills and slotting machines. Manufacturers of electrical appliances also were in the market for this class of goods. The saw and file business was reported on a satisfactory level, although the number of orders and the number of inquiries fell off somewhat during the last ten days. The lumber industry has been in the market for this class of equipment.

Producers of gears have a steady business for their goods, Pennsylvania steel mills having been purchasers. Inquiries among a varied line of industries show plants operating from 90 to 100 per cent of their full capacity.

New England

Machinery buying is by no means dull in the New England territory, but only in occasional places can it be described as active as it was last month. Generally speaking, manufacturers regard business, for the moment, spotty but there is a tone of optimism in the sentiment and nowhere are there indications of curtailment of production. On the contrary there are signs of expanding schedules by the employment of additional help. There is a shortage of skilled machinists and men of ability are readily employed.

Standard tools are in good demand and the foreign market for these is described as "good." Special machinery contracts are being offered and invitations to bid are numerous.

The automotive trade bought less during the past week than previously, and this is regarded as a reflection of the seasonal slowing up in this line. Such buying as has been observed is regarded as of the replacement variety.

Chicago

The last days of October witnessed a definite improvement in the condition of the machinery market, and the actual business in machine tools recorded since the first of November has been sufficiently brisk to create a feeling of optimism with respect to prospects for the entire month. Upon summarizing their business for October, several of the leading machinery houses find that, as compared with September, the volume showed up favorably.

One of the most prominent Chicago machinery manufacturing concerns, which also handles used tools in large quantities, reports that its October business was considerably in excess of the previous month, and that sales booked thus far in November, together with the inquiries received daily, indicate a continuance of activity.

The closing of lists by railroads and other industries which have issued them is slow. Those of the Illinois Steel Co. and the General Electric Co. are still pending. The International Harvester Co., the J. I. Case Threshing Machine Co. and the Santa Fe and St. Paul railroads have been doing some buying, but of single tools or small lots only.

Everything considered, the machine tool outlook is encouraging, with the indication that November will probably produce an average of business in excess of the same month last year.

Government Will Number All Airplanes in Use

The aeronautical branch of the Department of Commerce has been conducting a survey to determine the number of airplanes in the country, preparatory to issuing identification numbers to the planes. Each plane, whether privately owned or engaged in industrial or transport work, must bear an identification number which will be issued by the Department of Commerce.

It is estimated that there are between 3,500 and 5,000 planes flying about the country. Following the World War, the Army and Navy disposed of 1,511 planes to private individuals and concerns, in addition to selling separate parts and accessories which would build 500 additional planes. A total of 12,916 airplane engines were sold. If for every six operating planes, there might be considered four engines on the ground, the estimate of airplanes in existence would run up to 3,229, not counting the planes of the Army, Navy and Marine Corps air forces.

Begin Screw Thread Reduction Plan in Canada

At a recent conference in Toronto at which a number of manufacturers of machine screws and machine tools were represented, it was agreed that the machine screw situation in Canada could be greatly improved by a reduction in the number of varieties of threads.

The meeting, which was held under the auspices of the Canadian Engineering Standards Association, also decided that the carrying on of a campaign of education among customers would tend to reduce the variety of orders received. A sub-committee was appointed to investigate the matter further and to prepare tentative data sheets to show the standard screw threads which should be stocked.

All other threads than those included in the tabulation thus prepared will be classed as "special" and their use discouraged. The consensus of opinion among manufacturers is said to be that the Canadian market could be met with a two thread series using a close fit tolerance.

Canadian Foundries Show Bigger Volume

Production of the castings and forgings industry of Canada, according to a report just issued by the Dominion Bureau of Statistics, valued at $61,754,339 in 1925, marked a 7 per cent increase over the output of the previous year, which was valued at $57,494,495.

Firms listed in this industry are foundries engaged in making stoves and furnaces, machines and machinery and miscellaneous castings or forgings, made to order for all purposes. In the year under review 324 plants reported in this class, 188 being located in Ontario, 67 in Quebec, 24 in British Columbia, 17 in Nova Scotia, 10 in New Brunswick, 9 in Alberta, 5 in Manitoba, and 2 each in Prince Edward Island and Saskatchewan. They represented a capital investment in Canada of $84,812,411. During the year they employed a monthly average of 17,120 people, to whom $21,039,510 was paid in salaries and wages. These firms extended nearly two million dollars for fuel and electric power, and by manufacturing processes they added $39,231,978 to the value of purchased materials which cost $22,522,361.

Machinery Importers Unite in Czechoslovakia

Czechoslovak dealers in machinery are organizing a special section of the Central Merchants' Association of Czechoslovakia with a view to protecting the interests of machinery dealers at times when commercial treaties are in process of negotiation by the government, or other measures affecting machinery imports are under consideration.

As a large proportion of the machines and machine parts imported by Czechoslovakia are received from export houses in Berlin and Vienna, the Czechoslovak merchants, it is reported, will endeavor to bring about the direct importation of machinery, or at least to restrict the re-exportation from other countries.

A.E.S.C. Will Exhibit at Power Show in New York

The savings which standardization offers to American industry will be shown by the American Engineering Standards Committee in an exhibit at the Fifth National Exposition of Power and Mechanical Engineering to be held in the Grand Central Palace, New York, from Dec. 6 to 11.

Standardization of methods, of materials and of dimensions in one factory is the time-honored method of reducing manufacturing costs in American industry. Standardization throughout an industry is more recent in conception, while a national plan of standardization in co-operation with the standardization program of other countries is only now finding its place in the manufacturing industries of the United States. The American Engineering Standards Committee is the coordinating body for the promulgation of standards.

In the field of power and mechanical engineering, screw threads, fire hose couplings, steel flanges and flanged fittings, tolerances and allowances for machine fits in interchangeable manufacture, and bolts and nuts are occupying the attention of American industry.

In the exhibit of the American Engineering Standards Committee at the power show progress of these and other related fields will be demonstrated by interesting series of illustrated diagrams and samples of standard materials.

Employee Representation Subject of Meeting

The part played by employee representation in the present scheme of management will form the basis for a series of discussions at a two-day conference in Chicago, Nov. 18 and 19. The meetings will be held in the Palmer House and will be under the direction of the production executives division of the American Management Association.

Four sessions will be held, each one taking up some phase of the subject. The phases as outlined are: Various types of employee representation plans; selling, constructing and introducing an employee representation plan; what managerial problems should be discussed in meetings; employee representation as an agency for educating employees in economic aspects of business; evaluation of the results achieved by employee representation plans.

The speakers for these sessions have been drawn from practically every type of industry and the discussions are expected to bring out some interesting and valuable material.

British Steel Control Upheld by Courts

The British Empire Steel Corporation has succeeded in its effort to retain control of the Nova Scotia Steel and Coal Co., the court having refused the application for the appointment of a receiver and manager.

The decision in favor of the steel corporation is generally regarded as strengthening its hand in the event of any reorganization that may now be attempted. The decision will not effect in any way the position of the Dominion Iron and Steel Co., which was placed in the hands of a receiver early in July, with the full consent of the parent company.

Machinery Exports Increase

United States exports of industrial machinery in September were greater than any month thus far in 1926, with the exception of April, according to a report of the Industrial Machinery Division of the Department of Commerce. The total value of the September shipments was $14,391,358.

The volume of American industrial machinery shipments, it is stated, has shown a general upward trend since 1921 and this progress is being continued during the present year. The monthly average of these exports during the first nine months of this year amounts to approximately $12,988,000, as compared with an average of less than $12,500,000 for the 12 months of 1925.

German exports of machine tools and metal working machinery for the first six months of the present year greatly surpassed those for the same periods of 1925 and 1924, and have almost reached the pre-war figure.

Personals

F. H. Meyer has been appointed general manager of the American Welding and Manufacturing Co., of Warren, Ohio.

Durbin Hollingsworth has been appointed purchasing agent for the Nicholson File Works, Anderson, Ind.

Robert J. Tully has been appointed general superintendent of the New Castle Works of the Carnegie Steel Co., at New Castle, Pa.

L. F. Berry has been appointed representative in Jackson, Mich., for the Allis-Chalmers Co. He has opened offices at 512 Reynolds Bldg.

E. F. Jones has been elected president of the Park Manufacturing Co., of Worcester, Mass., manufacturer of screw machine products.

Samuel I. Kessler, of 9 Clinton St., Newark, N. J., has been appointed receiver for the Berry Automatic Lubricators Corporation.

C. J. Dillon has been appointed head of the employment department of the Fort Wayne, Ind., plant of the International Harvester Co., succeeding H. J. Morgan, who resigned.

John Parker has been appointed New England representative for the Rollway Bearing Co., Inc., of Syracuse, N. Y. Mr. Parker was formerly associated with the Brown & Sharpe Manufacturing Co.

L. A. Williams, who was one time draftsman and engineer for the Norton Co., at Worcester, Mass., and who left that concern to become associated with the Fore-river Shipbuilding Corporation, at Quincy, Mass., is being sought by the Norton Co. Information leading to his location will be appreciated.

Paul T. Irvin has resigned as manager of the small tools department of the Greenfield Tap and Die Corporation, of Greenfield, Mass. On Nov. 15 he will take charge of sales for the Bemis & Call Co., of Springfield, Mass., manufacturer of wrenches. Louis Battey has been appointed to succeed Mr. Irvin.

T. H. McGraw Jr. has been elected president of the Braeburn Alloy Steel Corporation, of Braeburn, Pa. Mr. McGraw has been chairman of the board of the corporation. He was formerly associated with the Standard Seamless Tube Co., and was general manager of the Carbon Steel Co.

Charles R. Boggs, factory manager of the Simplex Wire and Cable Co., of Boston, sailed for Europe on Nov. 7. He will visit on the Continent for about two months. During his stay abroad Mr. Boggs will present a paper before the Institution of the Rubber Industry, in London, on "Selenium in Rubber Compounds."

C. M. Peter, who formerly worked out of the Black & Decker branch at Kansas City, and who was sent to London a year ago to supervise the formation of Black & Decker Ltd., Kingsway, London, has returned from England after having completed this task and has been placed in complete charge of all export business for the company. Col. W. V. Franklin has been appointed managing director of Black & Decker Ltd. Oswald C. Kanitz, who has recently been appointed representative in Continental Europe for Black & Decker Ltd. of London, is at Towson, Md., at the present time and will spend three months with the home office of the organization before assuming his duties abroad.

Business Items

The National Machine Co.'s plant at Wethersfield, Conn., has been sold to the American Type Founders Co., of Boston. The shop equipment was also purchased. Affairs of the National Machine Co. are being closed.

The plant and business of Robert H. Hassler, Inc., Indianapolis, manufacturer of shock absorbers and automobile stabilizers, have been bought by Guy Lemmon and a group of New York and Chicago financiers.

The American Electric Corporation has changed its name to the Belding-Hall Electric Corporation. The offices of the company, now in New York City, will be moved to Belding, Mich. Charles Bohn, president of the Bohn Aluminum and Brass Co. is chairman of the board, and Arthur L. Cash, formerly vice-president of the General Motors Co., is vice-president and general manager.

The Royersford Foundry and Machine Co., Inc., has moved its general sales office from 52 N. 5th St., Philadelphia, to the plant, at Royersford, Pa. The office in Philadelphia is, however, being retained as a city sales office, in charge of H. S. Wiegand. E. Harold Neely is now covering greater New York and the New England States for the Royersford company. J. J. Dunphy has joined the Royersford forces, and will look after New York, Pennsylvania, Delaware and Maryland. Harry A. Lyon, formerly of the Bock Bearing Co., will take care of the company's interests in the states next west of Mr. Dunphy's territory.

At a recent meeting of the stockholders of Huff, Deland Airplanes, Inc., it was voted to increase the capital stock of the organization to over $1,000,000. At this same meeting Thomas H. Huff announced his retirement as president of the company and Edward N. Gott, recently vice-president of the Fokker Aircraft Co., of New Jersey, was elected president to succeed Mr. Huff. Prior to joining the Fokker company Mr. Gott was president of the Boeing Airplane Co., of Seattle.

The Chain Belt Co., of Milwaukee, manufacturer of elevating and conveying machinery, has taken over the Stearns Conveyor Co., of Cleveland, manufacturer of belt conveyors. This makes the sixth of a group of affiliated companies which now consists of the Chain Belt Co., the others being the Sivyer Steel Casting Co., the Federal Malleable Co., the Interstate Drop Forge, all of Milwaukee, and the Nugent Steel Castings Co., of Chicago. The Stearns company will continue to operate as a separate corporation with Earl D. Stearns as president. There are also branch offices at New York, Pittsburgh, Chicago and Salt Lake, some of which will be consolidated with the present Chain-Belt offices in the same cities.

Calendar of Local Meetings

Society of Automotive Engineers

Indiana Section. Nov. 11. "Application of Rubber in Vehicle Construction," by Charles Froesch and C. A. Schell.

Southern California Section. Nov. 12. "Low Cost of Fleet Operation," by C. G. Bussey, E. F. Rondot and E. M. Fitz.

Metropolitan Section. Nov. 15. "Engines," by W. A. Frederick.

Cleveland Section. Nov. 29. "The Engineer, the Trade and the Owner," by David Beecroft.

National Association of Cost Accountants

Boston Chapter. Nov. 18, national officers night.

Buffalo Chapter. Nov. 18. Subject: "Credit via the Balance Sheet," and "Insurance—Cost and Distribution," by W. F. Chase and Frank Vockrodt.

Cleveland Chapter. Nov. 17. Subject: "Defects in the Monthly Profit and Loss Statement," by W. B. Castenholz.

Detroit Chapter. Nov. 18. Subject: "Financial Control Policies of the General Motors Corporation," by Albert Bradley.

Erie Chapter. Nov. 15. Subject, "Fixed Asset Depreciation and Cost."

Hartford Chapter. Nov. 16. Subject: "Departmental Co-operation Within the Organization," and visit to plant of the Colts Patent Fire Arms Manufacturing Co.

Hawaii Chapter. Nov. 23. Subject: "Problem of Business Forecasting," by Prof. G. R. Kinnear, University of Hawaii.

Kansas City Chapter. Nov. 15. Subject: "Budgeting."

Los Angeles Chapter. Nov. 16. Subject: "Mechanical Devices in Cost Accounting."

Milwaukee Chapter. Nov. 18. Subject: "Standard Costs," by E. A. Camman.

Philadelphia Chapter. Nov. 19. Subject: "New Uses of Insurance," by Dr. S. S. Huebner.

Pittsburgh Chapter. Nov. 17. Subject: "Cost Accounting in Relation to Establishment of Rates and Selling Prices," by W. C. Wright.

Providence Chapter. Nov. 11. Subject: "Problems in Textile Costs," by C. W. Bennett.

Rochester Chapter. Nov. 17. Subject, "Payroll Analysis," by C. F. Brown.

St. Louis. Nov. 16. Subject to be announced later. Speaker—C. M. Doisseau.

San Francisco Chapter. Nov. 22. Subject: "Cost Accounting for Special Services as an Aid to Management."

Springfield Chapter. Nov. 17. Subject: "Development and Installation of Budget Systems," by H. N. Sweet.

Syracuse Chapter. Nov. 15. Subject: "Setting the Selling Price," by H. G. Crockett.

Twin Cities Chapter. Nov. 16. Subject: "The High Cost of Distribution."

Utica Chapter. Nov. 15. Subject: "Inventories," by C. M. Finney.

Worcester Chapter. Nov. 11. Subject: "Government Budgetary Control and Costs."

American Society of Mechanical Engineers

Philadelphia. Nov. 23. Power Meeting, speaker, N. E. Funk.

Cleveland. Nov. 16. Carnegie Hall. Subject: "Machine Tools," speaker to be announced later.

Detroit. Nov. 17. Detroit Engineering Society. Subject: "Forging Methods for Large Gun Barrels and High Pressure Boiler Drums," by Col. Henry W. Miller, University of Michigan.

New York. Nov. 23. Engineering Societies' Bldg. Subject: Recent Progress in Air Transportation," by J. E. Whitbeck; "Safety in Air Transport," by J. T. Trippe.

Western Massachusetts. Nov. 16. At Hartford, Conn. Joint meeting with Engineering Society of Western Massachusetts. Subject: "Mercury Boiler and Turbine Installation."

Forthcoming Meetings

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

Academy of Political Science. Forty-sixth annual meeting, Hotel Astor, New York, Nov. 17. Secretary's office, Kent Hall, Columbia University, New York.

National Founders Association. Thirtieth annual convention, Hotel Astor, New York, Nov. 17 and 18. J. M. Taylor, secretary, 29 South La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 6 to 9. Calvin Rice, secretary, 29 West 39th St., New York.

National Exposition of Power and Mechanical Engineering. Fifth event, Grand Central Palace, New York City, Dec. 6 to 11. I. E. Moultrop, chairman advisory committee, Edison Electric Illuminating Co., Boston, Mass.

American Association for the Advancement of Science. Annual meeting, University of Pennsylvania, Philadelphia, Pa., Dec. 27 to Jan. 1. Sam Woodley, executive assistant, Smithsonian Institution, Washington, D. C.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. W. Delchamps, chairman, meetings and sections departmment, 29 West 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

EXPORT demand for fuel and recent wage advances to miners have combined to force the price of pig iron upward. Thus far, the effect upon finished steel has amounted to nothing more than a slightly increased firmness at levels prevalent during the last few months. Surplus stocks of iron are not large. Aside from a sustained demand for rails and a slight improvement in heavy melting scrap, the market is slow in the principal steel items. Decreased volume of buying is especially noticeable at present in steel plates, shapes, bars, pipe, strips and sheets.

(All prices as of Nov. 5)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.19
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.76
Basic	20.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.40	3.50	3.25	3.89
No. 12	2.45	3.55	3.30	3.94
No. 14	2.50	3.60	3.35	3.99
No. 16	2.60	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90	3.75	3.60	4.15
No. 22	3.05	3.90	3.75	4.30
No. 24	3.10	3.95	3.80	4.35
No. 26	3.20	4.05	3.90	4.45
No. 28	3.35	4.20	4.05	4.60
Galvanized				
No. 10	3.25	4.10	3.95	4.40
Nos. 12 to 14	3.35	4.20	4.05	4.50
No. 16	3.45	4.30	4.15	4.60
No. 18	3.60	4.45	4.30	4.75
No. 20	3.75	4.60	4.45	4.90
No. 22	3.80	4.65	4.50	4.95
No. 24	3.95	4.80	4.65	5.10
No. 26	4.20	5.05	4.90	5.35
No. 28	4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	29	30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; ⅜ to ½, 7.35c. per lb. *Flat, ⅛@½-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			70.75
Lead (up to carlots) E. St. Louis	7.85	New York	8.62½
Zinc (up to carlots) E. St. Louis	7.30	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot.	16.00	19.50	15.00
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	19.75	19.75	19.75
Copper bars, base	22.37½	22.37½	22.37½
Copper tubing, base	24.75	24.75	24.75
Brass sheets, base	19.12½	19.12½	19.12½
Brass tubing, base	24.00	24.00	24.00
Brass rods, base	16.87½	16.87½	16.87½
Brass wire, base	19.62½	19.62½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	13.05	12.01
Solder (½ and ½), (case lots)	42.50	44.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	89.00
Commercial genuine, intermediate grade	63.00
Anti-friction metal, general service	32.50
No. 4 babbitt (f.o.b.)	14.00

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.25 @12.50	11.50	11.00@11.50
Copper, heavy, and wire	11.50 @12.00	12.00	10.25@10.75
Copper, light, and bottoms	9.75 @10.25	10.00	9.25@ 9.75
Heavy lead	6 62½@ 7.12½	7.25	6.50@ 7 00
Tea lead	4.75 @ 5.00	5.25	5.50@ 6.00
Brass, heavy, yellow	7.00 @ 7.50	7.50	6.75@ 7.25
Brass, heavy, red	9.25 @ 9.75	10.00	9.00@ 9.50
Brass, light	5.62½@ 6.12½	6.50	6.00@ 6.50
No. 1 yellow rod turnings	8.00 @ 8.25	8.50	7.50@ 8.00
Zinc	4.50 @ 4.75	5.00	3.75@ 4.25

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7 50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0 20
Cotton waste, colored, per lb.	.10@ .14	.13½	.12@ 17
Wiping cloths, washed white, per lb	.17½	36.00 per M	15
Sal soda, per 100 lb. keg	2.05	2.25	2 75*
Roll sulphur, per 100 lb	2.70†	3.50	4 25‡
Linseed oil, per gal., 5 bbl. lots	.84¾	.98	83
Lard cutting oil, 25% lard, per gal.	55	.50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb	.04	.04	.0415
Brass rods	per lb	.1687½	.1712½	.1687½
Solder (½ and ½)	per lb	.425	.4287½	.395
Cotton waste	per lb	.13@.17½	13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	55
Machine oil	per gal.	35	.35	35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.49
Cloth	3.10	3.50	3.75
Fire clay, per 100 lb. bag		.60	75
Coke, prompt furnace, per net ton	Connellsville,		5.00@6.00
Coke, prompt foundry, per net ton	Connellsville,		6.00@7.00
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry	100 lb. kegs	New York,	15.25
Red lead, in oil	100 lb. kegs	New York,	16 75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00 Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{1}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all dia meters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Chicago—New City Iron Works, 5401 South Western Blvd.—equipment including shears, punches, etc., to fabricate steel for proposed 1 story, 75 x 243 ft. factory.

Ind., New Castle—The Perfect Circle Co. foundry equipment for proposed 2 story, 60 x 200 ft. plant. Estimated cost $100,000.

Mass., Roxbury (Boston P. O.)—Baker, Selesnick & Coplan, 22 Watts St., Chelsea—additional machinery and equipment for repair and service garage at Hampden and George Sts. here. Estimated cost $50,000.

Mass., South Boston (Boston P. O.)—K. De Pietro, 424 Hanover St.—miscellaneous tools and equipment for prposed 1 story, 145 x 190 ft. repair and service garage at 45 West 3rd St. Estimated cost $80,000.

Mass., South Walpole—Bird Machine Co. additional equipment for proposed extension to machine shop.

Mich., Detroit—Dept. of Purchases & Supplies, Marquette Bldg., J. E. Mills, Comr. 2 drill presses, 1 die stock, 1 metal saw, 2 floor grinders for Board of Fire Commissioners.

Mich., Detroit — Peninsular Stove Co., Fort St. and Trumbull Ave. — machinery and equipment for the manufacture of stoves for proposed 1 and 2 story 750,000 sq.ft. factory.

Mich., Pontiac—Oakland Motor Car Co., Oakland Ave.,—complete foundry equipment for iron castings for proposed 1 story, 300 x 700 ft. foundry. Estimated cost $1,000,000.

Mo., Kansas City—G. W. House, 6612 East 13th St.—miscellaneous equipment for proposed 1 story, 25 x 50 ft. machine shop. Estimated cost $20,000.

Mo., Kansas City—Kansas City Public Service Co., 15th and Grand Sts.—machinery and equipment including lathes, dies, etc. for proposed machine shops, motor bus garages and car barns.

Mo., Kansas City—Missouri Casket Co., 2105 East 9th St.—woodworking machinery and tools for proposed plant. Estimated cost $100,000.

N. C., Mooresville—Mooresville Furniture Co.—woodworking machinery including trim and cut off saws, jointers, boring machines, sanders, etc.

O., Bellaire—Klein Structural Steel Co.—gate shear or multiple punch, 48 x ½ plate capacity.

Wis., Algoma—Metal Specialty Co., C. Schmitt, Purch Agt.—presses for the manufacture of metal specialties.

Wis., Clintonville—Topp-Stewart Co., c/o C. Topp (tractors, trucks, etc)—lathe, drill press, grinders and motors.

Wis., Green Bay—Northern Electric Co., Day St., J. G. Rosebush, Gen. Mgr.—10 ton electric traveling crane.

Wis., Milwaukee—Central Board of Purchases, J. W. Nicholson, Chief Buyer,—one 325 ton hydraulic tire press for service station.

Wis., Milwaukee—Grand Ave. Buick Co., 3521 Grand Ave.—grinder and drill press for proposed 2 story, 60 x 80 ft. service building. Estimated cost $40,000.

Ont., Tilbury—Citizens Lumber & Mfg. Co.—complete equipment for planing mills recently destroyed by fire.

Australia, Melbourne—Victorian Government Railways, will receive bids until Dec. 22 for one wheel lathe with electrical motors and control apparatus.

Opportunities for Future Business

Ill., Chicago—Sloan Valve Co., 4300 West Lake St., manufacturers of plumbers' supplies, awarded contract for the construction of a 3 story, 100 x 135 ft. addition to factory at 4340 West Lake St. Estimated cost $100,000.

Ill., Effingham—Vulcan Last Co., Portsmouth, O., manufacturers of shoe lasts, awarded contract for the construction of a 1 story, 150 x 800 ft. factory here. Estimated cost $125,000.

Ind., Ft. Wayne—P. Doege, is having plans prepared for the construction of a 2 story, 75 x 155 ft. garage and machine shop at John and Pontiac Sts. Estimated cost $42,000. A. M. Strauss, 705 Tri-State Bldg., Archt.

Ind., Ft. Wayne—Edmunds Electric Co. awarded contract for the construction of a 2 story, 40 x 121 ft. factory at 1300 Calhoun St. Estimated cost $40,000.

Ind., Plymouth—Plymouth Metal Working Co., will build a 1 story, 50 x 150 ft. factory. Estimated cost $40,000. Private plans.

Ind., South Bend—M. L. Hines, 521 West Colfax St., is receiving bids for the construction of a 3 story, 65 x 165 ft. garage and machine shop at 19 South Lafayette St. Estimated cost $90,000. M. E. Smith, 323 South Main St., Archt.

Ind., South Bend — Woodward Pattern Works, 321½ North Michigan Ave., is receiving bids for the construction of a 1 story, 40 x 100 ft. factory. Estimated cost $40,000. M. E. Smith, 323 South Main St., Archt.

La., Gouldsboro (mail McDonoghville)—Texas & Pacific Ry. Co., Dallas, Tex., awarded contract for the construction of a round house, machine and blacksmith shops, store house, etc., here. Estimated cost $850,000.

Mass., Brookline (Boston P. O.) — D. Miller, 43 Brookline Ave., had plans prepared for the construction of a 1 story welding shop. Estimated cost $40,000. A. J. Halfenstine, 143 Washington St., Archt.

Mass., Chicopee—C. F. Church Mfg. Co., Willimansett, manufacturers of plumbers' supplies, awarded contract for the construction of a 2 story addition to plant, here.

Mass., Everett (Boston P. O.)—Market Forge Co., Garvey St., will build a 2 story, 65 x 90 ft. factory. Estimated cost $40,000. Private plans.

Mass., Lawrence—J. W. Bolton & Son Inc., 9 Osgood St. manufacturers of machine knives, pulp and paper mill machinery, etc., awarded contract for the construction of a 2 story addition to factory at Osgood and Market Sts. Estimated cost $40,000. Noted Oct. 14.

Mass., South Boston (Boston P. O.) — Underwood Machinery Co., 110 Mt. Vernon St., will build a 1 and 2 story, 50 x 100 ft. factory. Estimated cost $40,000. Private plans. Noted Oct. 7.

Mass., Worcester — American Steel & Wire Co., 94 Grove St., will build a 90 x 388 ft. billet storage building, 46 x 365 ft. billet mill, 100 x 260 ft. rod mill, etc., all 1 story. Estimated cost $1,000,000. A. F. Backlin, Rockefeller Bldg., Cleveland, O., Engr.

Mich., Detroit—Packard Motor Car Co., 1580 East Grand Blvd., is having plans prepared for the construction of a factory. Sessions Engineering Co., General Motors Bldg., Engr.

Mich., Muskegon—March Irrigation Co., Western Ave., manufacturers of irrigation machinery, awarded contract for the construction of a 1 story, 66 x 200 ft. factory on Bank St. Estimated cost $40,000. Noted Nov. 4.

Mich., Muskegon—Vanderwest & Child, Montgomery Blk., Archts., will receive bids about Dec. 1, for the construction of a 2 story, 32 x 120 ft., 1 story, 120 x 160 and 120 x 192 ft. piston ring factory for Panyard Machine & Mfg. Co., 296 West Western Ave. Estimated cost $40,000.

Mo., Kansas City—American Steel Works, C. R. Houston, Pres., 2844 South West Blvd., will build a 1 story, 60 x 130 ft. steel fabricating plant. Private plans.

Mo., St. Louis—Dixie Machine Mfg. Co., 3665 Market St., manufacturers of swing hammer crushing and pulverizing machines, awarded contract for the construction of a 1 story, 90 x 99 ft. plant. Estimated cost $40,000.

Mo., St. Louis—Pacific Electric Mfg. Co., 5815 3rd St., San Francisco, Calif., has acquired a site and plans the construction of a 1 and 2 story plant at Terminal Belt R.R. here. Estimated cost $175,000. Private plans.

N. J., Plainfield—City awarded contract for the construction of a 3 story fire station and machine shop. Estimated cost $176,990.

N. Y., New York—F. A. D. Andrea, 1581 Jerome Ave., manufacturers of radio equipment, will soon receive bids for the construction of a 4 story, 160 x 225 ft. plant. Estimated cost $350,000. The Ballinger Co., 100 East 42nd St., Archt.

O., Cleveland—Fanner Mfg. Co., Brookside Park Blvd., awarded contract for the construction of a 1 story, 30 x 135 ft. addition to foundry. Estimated cost $40,000.

O., Cleveland—Geometric Stamping Co., 221 East 131st St., awarded contract for the construction of a 1 and 2 story, 115 x 137 ft. addition to factory. Estimated cost $50,000.

O., Dayton—International Tool Co., 138 North Madison St., will soon receive bids for the construction of a factory on Overlook Ave. Estimated cost $100,000.

O., Mansfield—Barnes Mfg. Co., 701 North Main St., manufacturers of pumps, had plans prepared for the construction of a 1 story, 52 x 185 ft. foundry. Estimated cost $100,000. George S. Rider Co., Century Bldg., Cleveland, Archt.

Okla., Oklahoma City — Crane Co., 836 South Michigan Ave., Chicago, Ill., manufacturers' of plumbers' supplies, had sketches made for the construction of a 2 story, 84 x 180 ft. warehouse and office building, pipe cutting and threading shop, pipe storage shed, etc., here.

Pa., Scranton—F. Wesel Mfg. Co., Harry and Cranberry Sts., Brooklyn, N. Y., will soon award contract for the construction of a 1 story, 200 x 480 ft. plant and machine shop here. Lockwood, Greene & Co., 10 East 42nd St., New York, N. Y., Archts. and Engrs.

Pa., Philadelphia — R. L. Binder, 497 North 3rd St., manufacturer of electrical supplies, plans the construction of a 5 story, 50 x 160 ft. factory at American and Battonwood Sts. E. A. Stopper, 10 South 18th St., Archt.

Wis., Elkhart Lake — Sortograph Co., manufacturers of counting machines, awarded contract for the construction of a 2 story, 57 x 60 ft. addition to factory. Estimated cost $40,000.

Wis., Janesville — Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, Mich., awarded contract for the construction of a 1 story, 162 x 280 ft. addition to factory, here. Noted Nov. 4.

Wis., Muscoda—Marcus, Harrison & Sons Co., manufacturers of insulator pins and brackets, will build a 1 story, 60 x 200 ft. plant. Estimated cost $40,000. Private plans.